The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

Vol. XVIII. No. 5
$2.00 a year 20 cents a copy

MAY, 1921

New York Office. 1123 Broadway
Published at Cooperstown, N. Y.

Efficiency, Economy, Convenience in this wonderful boiler

Efficiency, because our exclusive carburetor chamber catches the gases of combustion and ignites them, thus adding greatly to the heating power of the boiler.

Economy, because the use of these ordinarily wasted gases saves greatly on fuel.

Convenience, because the Novelty burns either hard or soft coal without smoke—because the side door construction permits the addition at any time of further sections without increasing the grate depth which is never over 40 inches.

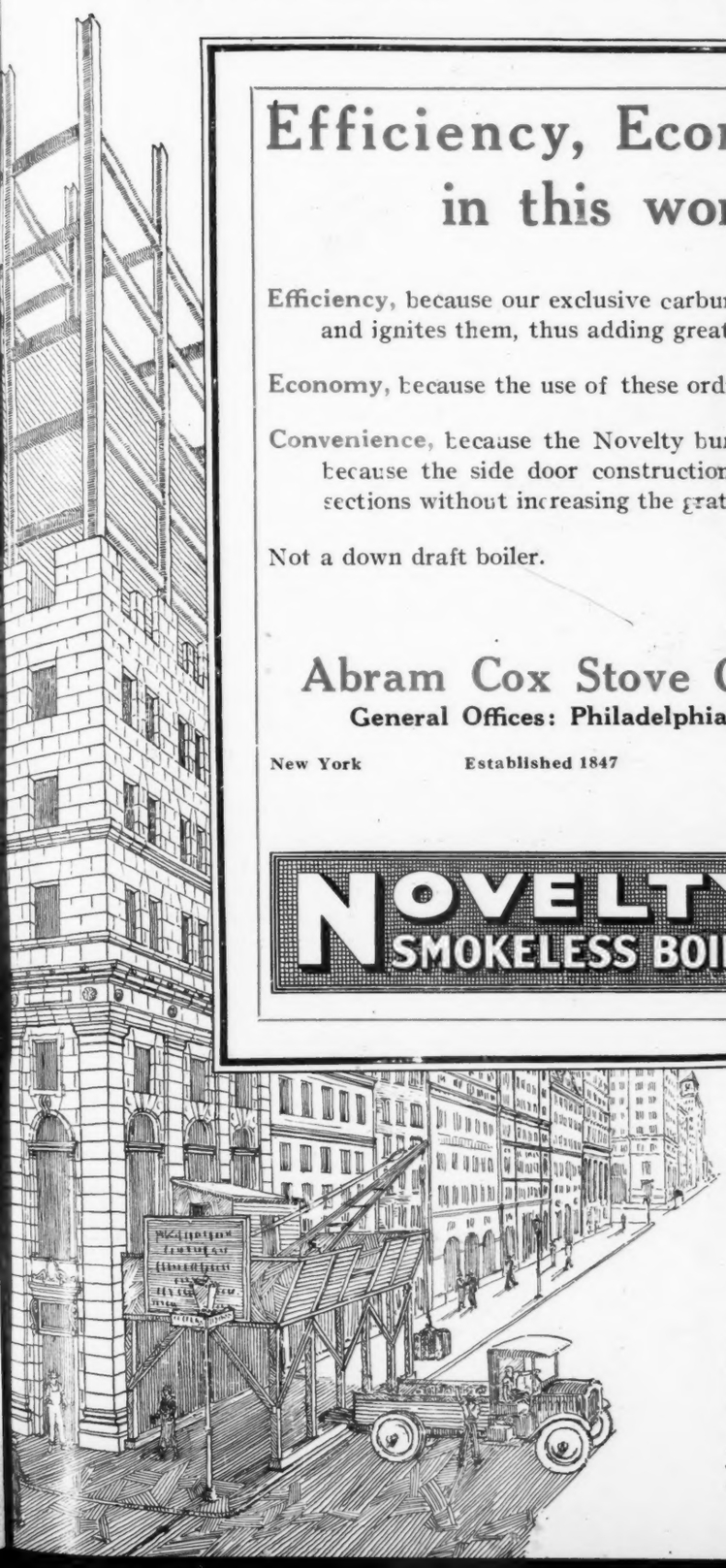
Not a down draft boiler.

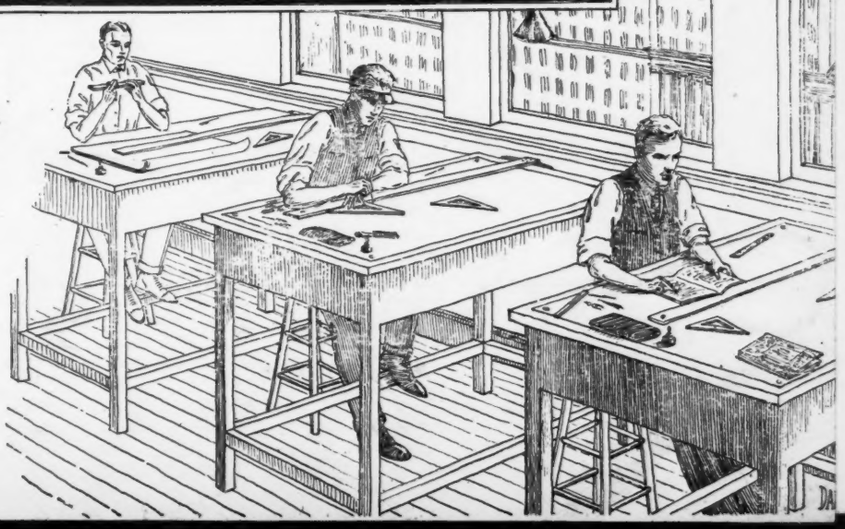
Abram Cox Stove Co.

General Offices: Philadelphia

New York Established 1847 Chicago

NOVELTY SMOKELESS BOILER

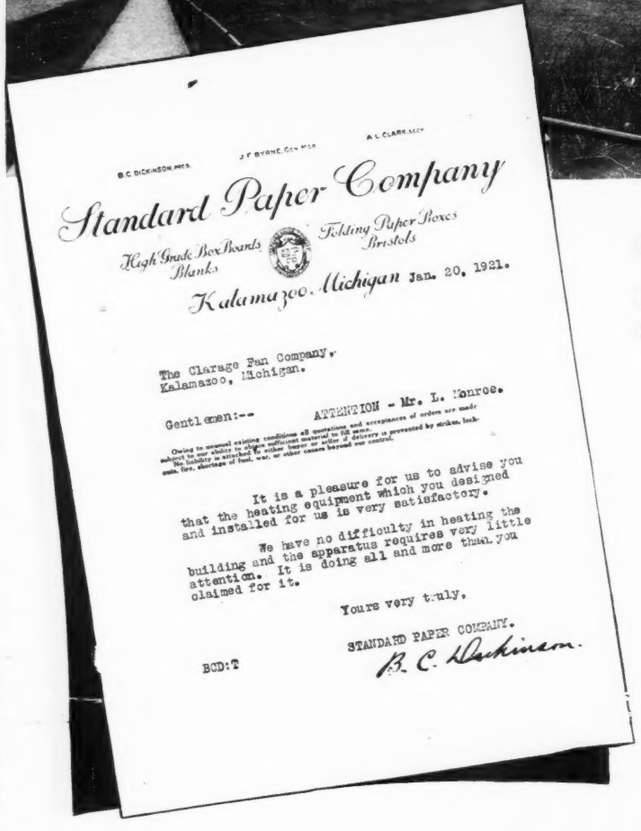




CLARAGE
KALAMAZOO

ONE COST— for Both Heating and Ventilation

A Clarage System was installed over a year ago in this new Paper Box Factory of the Standard Paper Co., Kalamazoo, Michigan. The interior view gives a glimpse of the piping and fresh air outlets. Clarage Engineers designed the entire heating and ventilating system. G. G. Worden of Kalamazoo was the Architect for the building.



B.C. DICKINSON, PRES. J.F. BYANE, GEN. MGR. A.L. CLARK, SEC'Y

Standard Paper Company

High Grade Box Boards Blanks — Folding Paper Boxes Bristols

Kalamazoo, Michigan Jan. 20, 1921.

The Clarage Fan Company,
Kalamazoo, Michigan.

Gentlemen:— ATTENTION - Mr. L. Monroe.

Owing to unusual existing conditions all quotations and acceptances of orders are made subject to our ability to get sufficient material to fill same.
No liability is attached for delay in either factory or order of delivery is prevented by strikes, lock-outs, fire, shortage of fuel, war, or other causes beyond our control.

It is a pleasure for us to advise you that the heating equipment which you designed and installed for us is very satisfactory.

We have no difficulty in heating the building and the apparatus requires very little attention. It is doing all and more than you claimed for it.

Yours very truly,

STANDARD PAPER COMPANY.

B. C. Dickinson.

BCD:T

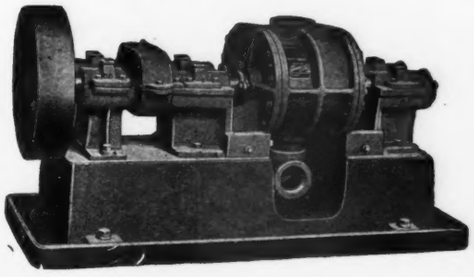
ONE first cost covers both heating and ventilation, if you install a Clarage Fan Blower System. And this cost is not excessive.

With a Clarage System, your workmen have fresh, pure air from out-of-doors the year around —warmed in winter, cool in summer. This good, wholesome air in your factory will keep your workers wide-awake and on their toes every minute. Further—the equipment located in one place, offers economy of space, reduces the cost of steam connections, and affords control by one man.

Why not have our engineers cooperate with you on your heating problems? Write, wire or phone us today.

Clarage Fan Company
404-10 Porter Street
Kalamazoo, Michigan

Manufacturers of Fans, Blowers, Heaters, Engines, etc.



"Now is the Time to Replace, Repair and Improve Equipment"

This sound advice is given by the editor of a machinery trade journal, but will apply as truly to your heating plant. When the system is closed down is the best time to inspect piping, traps, pumps and boiler. Needed adjustments can then be made.

If your system includes a Connersville Vacuum Pump, write us for estimated costs of repairs or replacement.

The Connersville Blower Company

Connersville Indiana U.S.A.

Chicago, 1431 Monadnock Block New York, 114 Liberty Street

Marsh Reflux Junior Thermostatic Traps

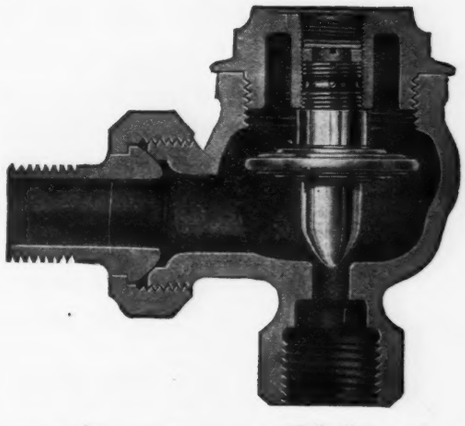
For Radiators and Coils of "Low Pressure," "Vapor" and "Vacuum Heating Systems"

FREELY DISCHARGES AIR AND WATER WITHOUT LOSS OF STEAM

THE Marsh REFLUX Return Line Trap is for use on the return end of radiators of low pressure, vapor or vacum systems of heating. It is the result of a careful investigation into the actual requirements that must be fulfilled by a radiator return valve, in order that it may accomplish what is desired of it, namely, to **free the radiator of air and water without the loss of steam** and to do so **noiselessly.**

The Marsh Reflux Junior Thermostatic Trap is recommended for small radiators and coils. This Trap for the small and the Original Reflux for the large units will make an ideal job. Especially adaptable for two pipe gravity work and vapor systems.

May be furnished either sealed adjustment (as illustrated) or with outside adjustment.



Write for literature fully describing this Trap

JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago

Founded 1865

Manufacturers of Gauges for all Pressures **Automatic Air Valves and Steam Specialties**

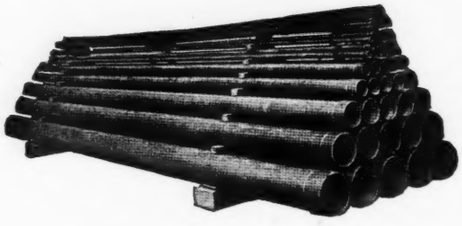
Agents for Great Britain and Ireland: Chatterton & Co., 30 Fetter Lane, E. C. 4, London
Agents for Dominion of Canada: Taylor-Forbes Co., Ltd., Guelph, Ontario

JOHN SIMMONS CO

110 Center Street, New York

IRON AND STEEL PIPE—FITTINGS—VALVES

RAILWAY
MILL
and
FACTORY SUPPLIES



STEAM SPECIALTIES
FIRE PROTECTION
EQUIPMENT
FIRING TOOLS

Sole Distributors for this section of WM. POWELL CO.'S HIGH GRADE VALVES and DEPENDABLE ENGINEERING SPECIALTIES

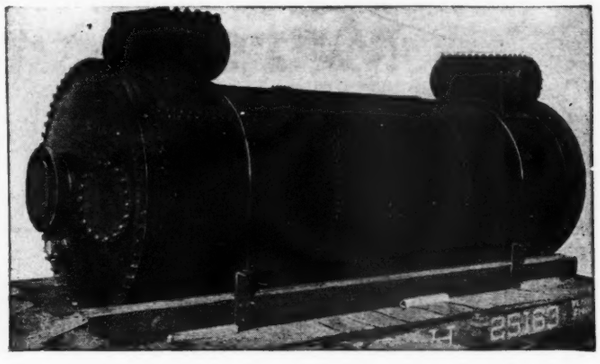
PIPE COILS and BENDS — PLUMBING SUPPLIES

Special Literature Sent on Request

WHITLOCK
Type B Heaters

Built from 500 H. P. up

WITH TWO IMPORTANT FEATURES OF DESIGN



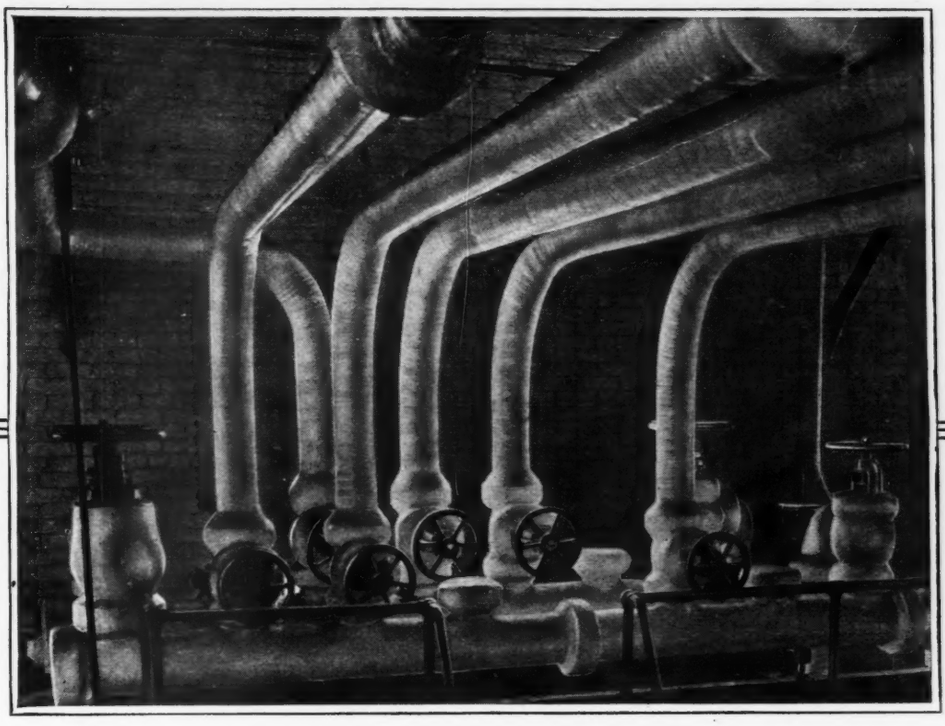
1. The **Even Flow Principle**—in which a uniform burden is placed on each coil, proportionate to its length and diameter.
   This insures **efficient** operation.
2. The **Header Construction**—in each coil terminal is expanded into a tube sheet cast integral with the header. Thus each coil acts independently and an accident to one cannot affect the others.
   This insures **uninterrupted** operation.

Described and illustrated in Bulletin 13

THE WHITLOCK COIL PIPE COMPANY, Hartford, Conn.

New York Boston Chicago Buffalo Philadelphia

"Whitlock Heaters Have Everlasting Copper Tubes"



A properly designed system installed with

CRANE
Piping Equipment

insures safety, reliability, and a minimum maintenance cost.

We are manufacturers of about 20,000 articles, including valves, pipe fittings and steam specialties, made of brass, iron, ferrosteel, cast steel and forged steel, in all sizes, for all pressures and all purposes and are distributors of pipe, heating and plumbing materials.

SALES OFFICES, WAREHOUSES AND SHOWROOMS:

BOSTON, SPRINGFIELD, HARTFORD, BRIDGEPORT, ROCHESTER, NEW YORK, HARLEM, ALBANY, BROOKLYN, PHILADELPHIA, READING, ATLANTIC CITY, NEWARK, CAMDEN, BALTIMORE, WASHINGTON, SYRACUSE, BUFFALO, SAVANNAH, ATLANTA, KNOXVILLE, BIRMINGHAM, MEMPHIS, LITTLE ROCK, MUSKOGEE, TULSA, OKLAHOMA CITY, WICHITA, ST. LOUIS, KANSAS CITY, TERRE HAUTE, CINCINNATI

FOUNDED BY R. T. CRANE, 1855

CRANE CO.

836 S. MICHIGAN AVE.

CHICAGO

WORKS: CHICAGO AND BRIDGEPORT

INDIANAPOLIS, DETROIT, CHICAGO, ROCKFORD, OSHKOSH, GRAND RAPIDS, DAVENPORT, DES MOINES, OMAHA, SIOUX CITY, MANKATO, ST. PAUL, MINNEAPOLIS, WINONA, DULUTH, FARGO, WATERTOWN, ABERDEEN, GREAT FALLS, BILLINGS, SPOKANE, SEATTLE, TACOMA, PORTLAND, POCATELLO, SALT LAKE CITY, OGDEN, RENO, SACRAMENTO, OAKLAND, SAN FRANCISCO, LOS ANGELES

CRANE LIMITED — MONTREAL, TORONTO, VANCOUVER, WINNIPEG, CALGARY, REGINA, HALIFAX, OTTAWA, QUEBEC, LONDON, ENG.

Why Does the Janitor Smile?

INTERNATIONAL ECONOMY BOILERS

SMOKELESS TYPE

Any janitor will smile—if his building depends for its heat on an **INTERNATIONAL ECONOMY SMOKELESS BOILER.**

It was designed with his problem in mind and does not require any special methods of firing or frequent attention. The excess air can be controlled at the feed door to suit the conditions of the fire, an important feature when burning soft coal.

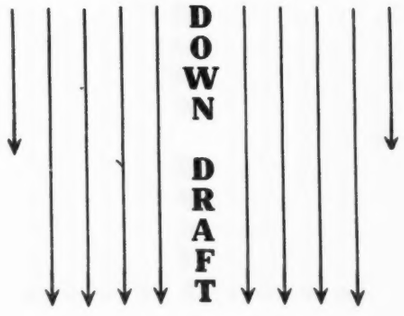
These and many other distinctive features fully explained in Bulletin 1436-H. *Send for your copy.*

INTERNATIONAL HEATER COMPANY, UTICA, N. Y.

Branch Offices and Warehouses at New York Chicago Greensboro, N. C. Nashua, N. H.

IMICO Heating Boilers

Smokeless

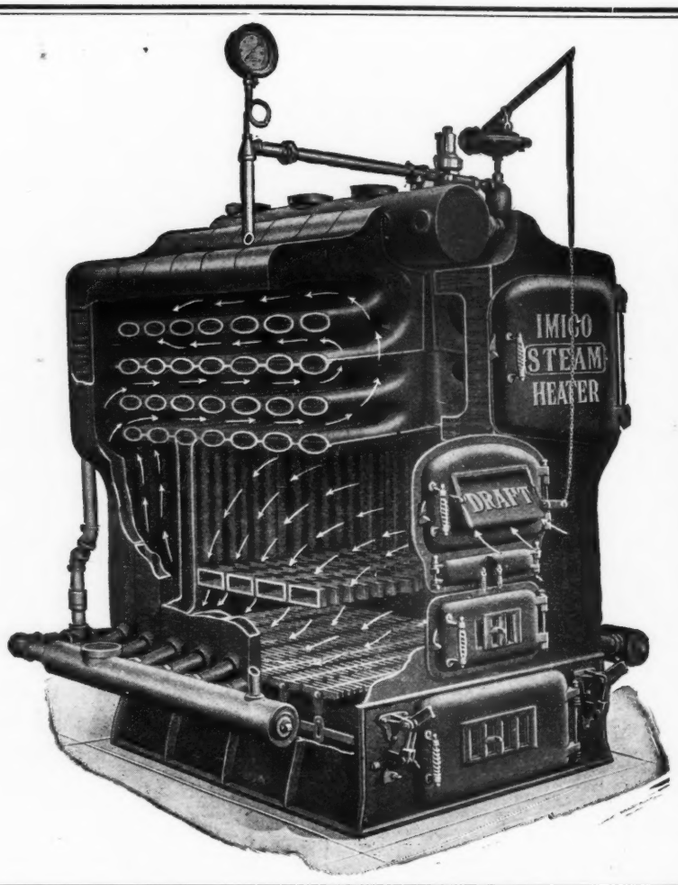


For Water or Steam

Our Catalogue describing our complete line of Heating Apparatus sent on request

Illinois Malleable Iron Co.

Chicago



SPENCER
MAGAZINE FEED
HEATERS

An Announcement

SPENCER Heaters, produced for more than fifteen years by the Spencer Heater Company, Scranton, Pa., are now manufactured and sold exclusively by the Standard Heater Company, of Williamsport, Pa.

This new organization considers that its first responsibility is to the owners of Spencer heaters now in use. Continued satisfaction for these owners is assured by the Standard Heater Company's preparedness to maintain service and promptly supply repair parts.

In addition, the new organization is devoting its efforts to the continuance of Spencer quality and the development and perfection of every feature that will add to the splendid record of success and economy of Spencer Heaters for steam, vapor and hot water, in both tubular and cast iron sectional types.

The economy of this buckwheat coal burning, magazine feed heater is emphasized by present fuel conditions, and it is the purpose of the new Company to make the Spencer Heater more generally available to the architects and heating contractors of the country.

This wide distribution and service will be carried out through Standard Heater Company offices in Boston, New York, Philadelphia, Buffalo, Detroit and Chicago.

STANDARD HEATER COMPANY
Williamsport, Pa.

CONNERSVILLE

Centrifugal Type VACUUM CLEANERS

Sisters Hospital, Lima, Ohio
Meyer J. Sturn, Archt., Chicago

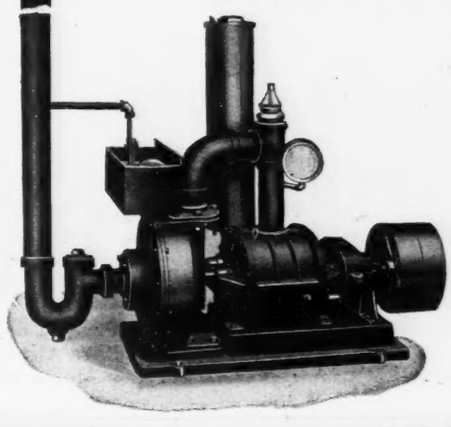
Automatic Disposal of Dust and Dirt—

is most important where it is necessary to dispose of disease germs in hospitals and similar institutions.

The Sisters Hospital at Lima, Ohio, and the Mercy Hospital at Toledo, are both equipped with centrifugal separating type Connersville Vacuum Cleaners.

All dust and dirt are continuously discharged directly into the sewer. The separation is simple and automatic at all times. Cleaners are made up to twelve sweeper capacity.

LANDERS, FRARY & CLARK
U. V. A. Div., Dept. C, CONNERSVILLE, IND.



A Saving of 1-3 of the Initial

How Re-Circulated, Ozonized Air

TO obtain good ventilation the air in a room must be *changed completely several times per hour.* It is self-evident that considerable heat would be saved if the air could be recirculated within the building.

This would be a general solution of the problem were it not for the fact that *re-circulation* brings in bad air troubles. The air becomes "stale" and absorbs many bad odors, thus causing an unhealthy and uncomfortable condition. But this problem is easily solved by a system that rids this *re-circulated* air of all odors by supplying fresh *ozone,* thereby revitalizing the air.

How to Figure the Saving of Fuel by Re-circulating the Air

This is accomplished by reducing the amount of outside air to be introduced into the building to approximately 15% of the total air that is circulated through the rooms. We therefore save the heat necessary to raise the other 85% of the air used from the outside temperature to the final temperature at which it is introduced into the room.

Let us take a typical building heated entirely by means of hot air introduced by fans and heated by tempering and reheating coils. A final temperature of approximately 135 degrees is necessary at the fan outlets to produce a temperature of 70 degrees *in the rooms.*

A 25-unit Equipment Ozone Pure Airifier
Capable of Ozonizing 25,000 cu. ft. of Air per Minute

The difference in fuel consumption—*outside,* zero-air to—*re-circulated,* 65-same 135

If the outside temperature is zero and *all* the air is taken from the outside, this air will have to be raised 135 degrees in temperature. If, however, the air of the rooms is *re-circulated* and only 15% of the outside air introduced, then 85% of the air will have to be raised from only 65 degrees (the temperature of the air at leaving the rooms) to 135 degrees, or but 70 degrees. Therefore, if 85% of the air is raised 70 degrees and 15% is raised

And, also saves of your

135 degrees, the *average* raise is only *80* degrees, or a saving of 45%. It is easy to figure the *saving in* fuel that will be brought about by this saving of air heating.

In what is termed the "split system," in which enough direct radiation is installed in the rooms to take care of the wall and glass losses, the air is delivered to the rooms at about 80 degrees. As the *re-circulated* air in this case would only have to be raised ten degrees the saving as far as the air change loss is concerned is 75%.

The fuel required for the direct radiation is constant, but as the indirect radiation averages about 65% of the total equivalent direct radiation installed, the overall saving in this case at 0 (zero) degrees outside temperature would be approximately 49%.

Cost of Your Heating Plant!!!

in Ventilating Systems is Saving Fuel

While some engineers think that where Ozone *Pure-Air*ifiers are installed a fuel saving of 50 per cent is possible, we are content to produce a saving of 20 to 25 per cent. One engineer, who is making a test of ozone, says that if it will save but 10 per cent of his fuel bill he will recommend installing one in every school in his city.

The success of any *ozone* apparatus depends on the use of a static discharge instead of an electric spark. If a spark is used, considerable nitrous

sumption between raising 135 degrees, and degree air to the degrees—

oxide is formed, which is a very destructive agent. The only way to avoid the production of nitrous oxide is to keep the electrodes in direct contact with the dielectric. This necessitates the use of pointed electrodes, producing a continual faint glow of current. Inasmuch as both of these features are covered by basic patents *owned by us* it is apparent that the "*Ozone Pure Air*ifier" is the only com-

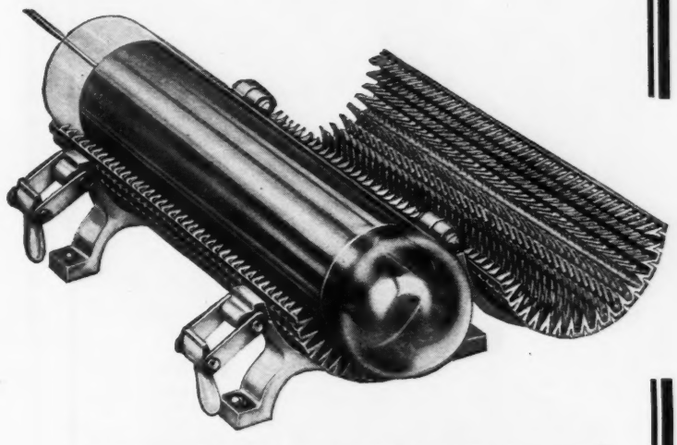
25 to 50 per cent fuel bills—

pletely successful *ozone* generating apparatus for air purification that can be offered to the public.

The Ozone *Pure Air*ifier shown in Fig. 1, for installation in the air ducts supplying the building, solves the problem of economically heating and ventilating large buildings.

Current Consumed

The current consumed by the apparatus is extremely small, being only about 120 watts maximum for a 25,000 cu. ft. machine when operating on alternating current. Based on a current cost of 10c per kw. hr., this would give a cost of 12c per 10-hour day.



One complete Unit of 1,000 Points Each
Opened to Show How Easily the Cylinders May be Cleaned, if Necessary

In using the Ozone *Pure Air*ifier where air washers are used, the amount of *Ozone* injected into the air will also purify the recirculating water of the air washer, making it unnecessary to install a separate Ozone *Pure Air*ifier for the water system.

The Ozone *Pure-Air*ifier does not (nor is it intended that it should)supplant ventilation, but, only supplements it. Nor is it designed to take the place of air washers, but can be used either with or without. We recommend air washing with proper humidity control for cooling purposes.

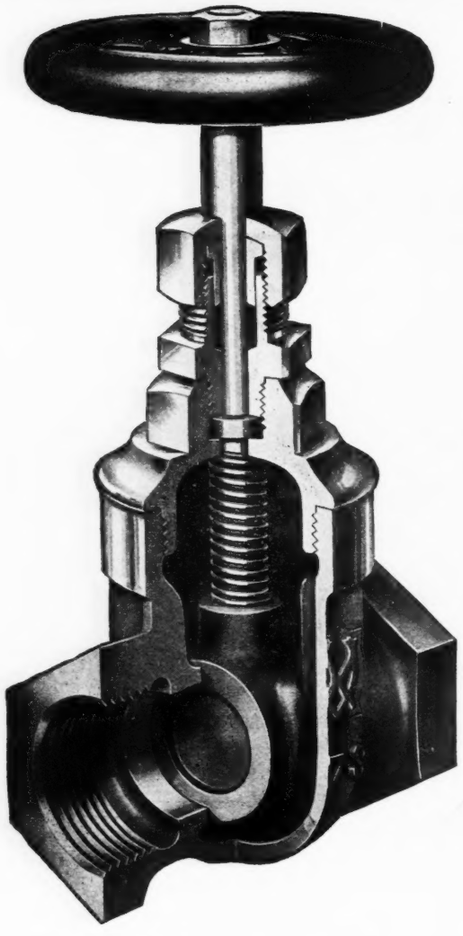
A recognized Heating and Ventilating Engineer of Kansas City says:

"Your Ozone *Pure Air*ifier not only improves the condition of the air, but in addition is a large fuel saver. In the fifteen years that we have been in the heating and ventilating engineering field, we do not recollect of any device that we see greater prospects for than the *Ozone* apparatus."

The Ozone *Pure Air*ifier is made in any size desired to meet exact requirements. Knowing the amount of air that it is necessary to circulate per minute, in any building in question, any engineer can immediately figure the number of cylinders required when specifying the Ozone *Pure Air*ifier.

The Ozone *Pure Air*ifier is an apparatus produced by an organization which has been in the air purification business for *over twelve years,* having manufactured Ozone *Pure Air*ifiers for all classes of buildings and to have met with unqualified success almost every possible "bad air" condition.

OZONE PURE AIRIFIER CO., 1403 W. Jackson Blvd.
CHICAGO, ILL.



You don't have to worry about the inside of

KENNEDY VALVES

They are made to last and they *do* last

THE KENNEDY VALVE MFG. CO. ELMIRA, N.Y.

MEMBERS THE NATIONAL TRADE EXTENSION BUREAU OF THE PLUMBING AND HEATING INDUSTRY. PERMIT No 76 REGISTERED.

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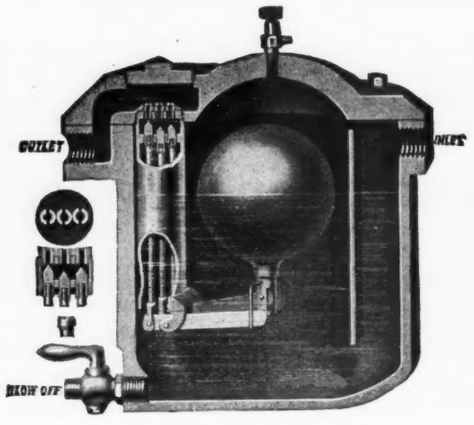


Assures Dry Steam

The Wright "Emergency" 3-valve High-Pressure Automatic Continuous Flow Steam Trap increases the efficiency of heating equipment because it drains all accumulated condensation from steam lines, and does it without steam waste.

The "Emergency" Trap is but one of the Wright-Austin "steam-savers" which are guaranteed and are installed on trial.

Send for a copy of our catalogue which completely describes the Wright-Austin Steam Specialties.

WA Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN COMPANY

Detroit, Mich., U. S. A.

Branch Offices:

New York Boston Chicago

Representatives Everywhere

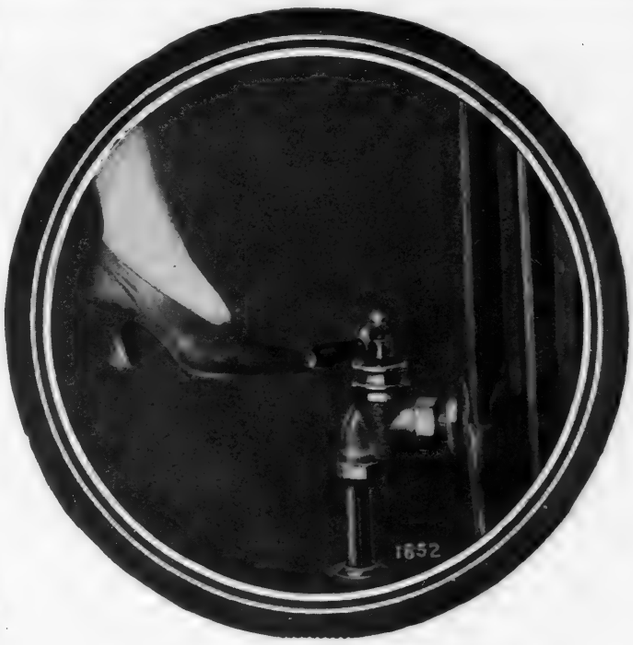
(17)

A Quarter Turn of the Handle Opens or Closes the

GORTON
QUICK-OPENING
VALVE

It moves with a touch of the foot or hand—quarter turn does the trick. Prevents opening a window to cool a room quickly (with resultant waste of steam and coal) for it is easier to operate the radiator with Gorton valve than it is to open windows.

There's a real saving for both your client and yourself in our suggestion that you write for full particulars.



No stooping. The slightest touch of the foot operates the valve.

Here are the Details of this Remarkable Valve

A. The valve with a packing lock—Acknowledged the best type of valve packing.

B. A ground ball shoulder fitting on a ground seat, Steam and water tight, and stays tight.

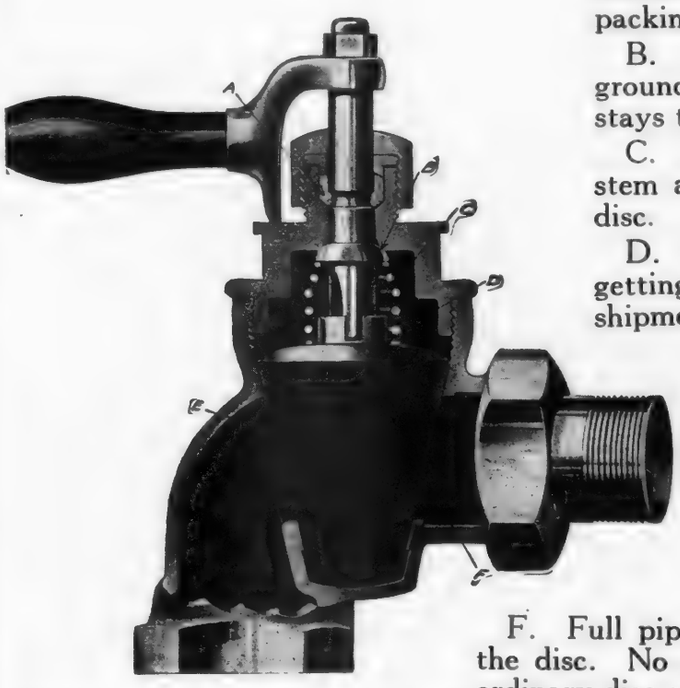
C. Loose joint connection between valve stem and disc—insuring perfect seating of disc.

D. Bronze spring prevents grit or dirt getting between disc and valve seat during shipment.

E. Mineral composition disc, no metal, sulphur nor rubber. Disc and seat both machine ground to a perfect taper surface, giving perfect seat.

A combination proof against rusting, wedging, cutting, abrasion and leaking.

F. Full pipe size unobstructed passage through the disc. No obstruction to passage of steam as in ordinary disc valve.



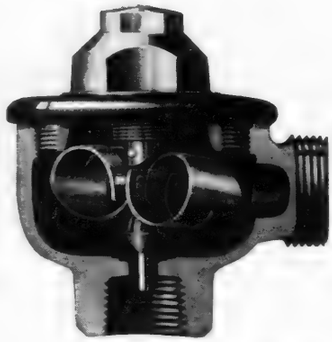
Radiator or Straightway—with or without Union

Equip your Radiators with Gorton Valves and save money on the coal pile

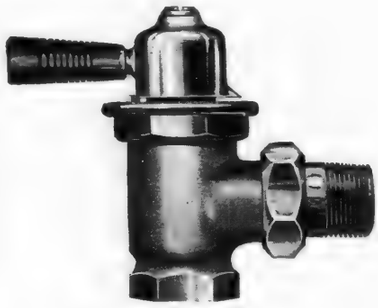
GORTON & LIDGERWOOD CO., 100 Liberty St., New York, N. Y.

See Sweet's Architectural Catalog, page 1757, for Specifications—Write for Catalogs.

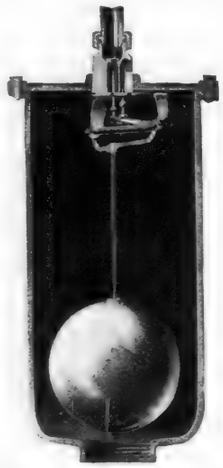
Business Builders



"The Trap Without a Diaphragm"



"The Trane Graduated Vapor Valve"



"The Trane No. 2 Direct Return Trap"

THAT the Trane System of Vapor Heating is a real business builder is amply proven by the experience of our customers. It is expressed in the satisfaction of thousands of satisfied users in buildings of every description.

Equipped throughout with high grade heating specialties that have stood the real service tests of permanency and dependability, Trane Systems have established an enviable record for economical and efficient heating results.

Trane Products are worth while builders of business good will, and they are backed by a valuable and nationally known engineering service that is always at your disposal. It will pay you to

Write for Bulletins today

The Trane Company

Established 1883

206 Cameron Ave. La Crosse, Wis.

Chicago Boston New York Philadelphia
Washington Harrisburgh Salt Lake City

LA CROSSE TRADE TRANE MARK WISCONSIN

Norbury Sanitarium, Jacksonville, Illinois

Jacksonville Plumbing & Heating Co., Heating Contractors

This building is heated by Moline Heat from a boiler plant in a laundry building separate from this building without any pumps or any automatic traps on the radiators.

SIZE CHARACTER or LOCATION

It Makes No Difference

That's one of the reasons why progressive heating contractors prefer to figure on and install Moline Heat. It standardizes their work. It makes their heating business easier to handle and consequently more profitable.

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C. L. Wenger, Heating Contractor

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O. Cunningham Residence. Baxter, Ia.
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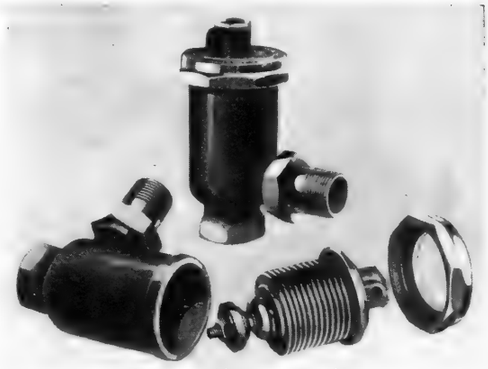

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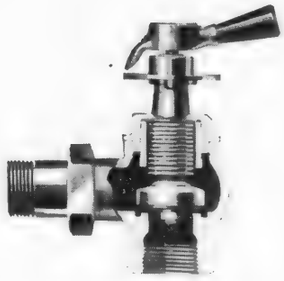
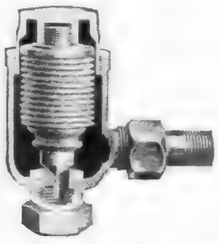
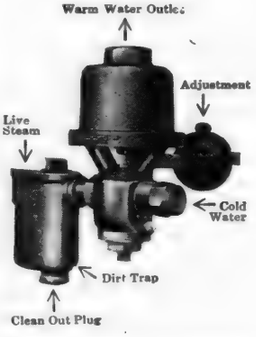


B & B Multiflex Modulation Valve



B & B Multiflex Trap

After Work is Over



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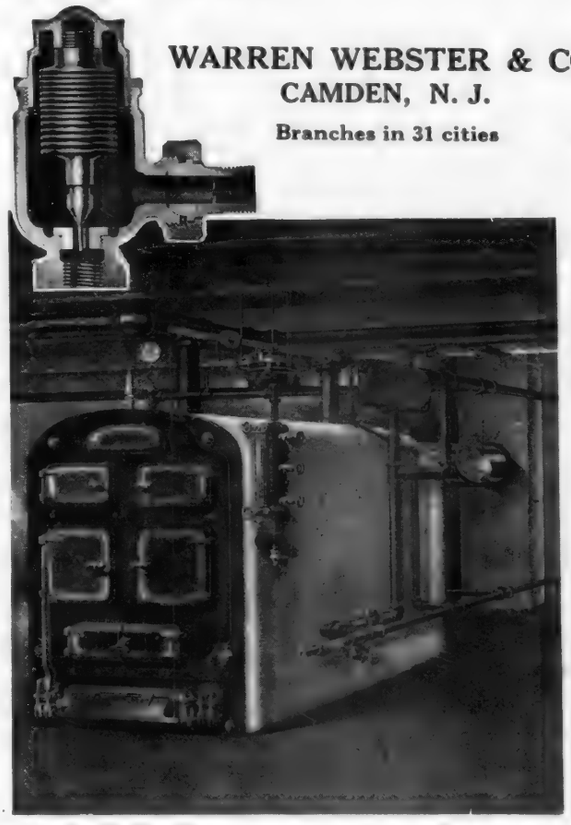
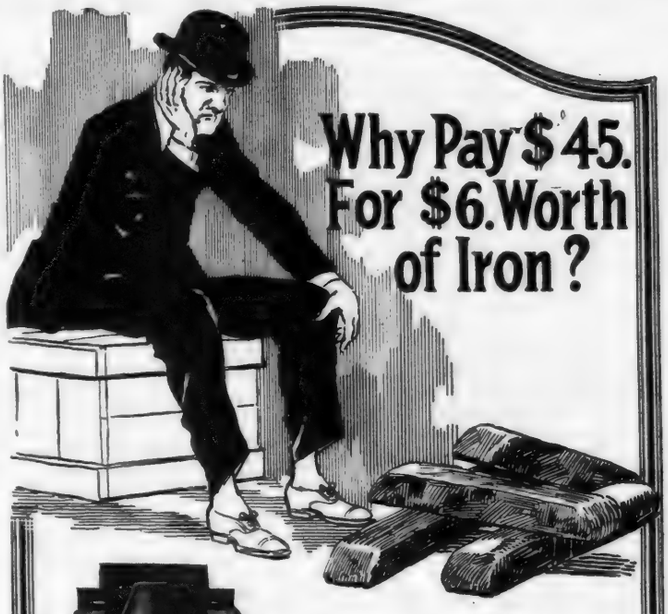


Typical Boiler Connections and Arrangement of Webster Appliances for the Webster Modulation System



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Can a Barrel be Emptied through the Bunghole as quickly as it can be filled through the Open Head?

Seems like a foolish question. Yet this is the principle on which most steam traps are designed—with an opening of only ¼" in the discharge valve while the pipe connection has a 1-½" hole. And then you wonder why you require such a large, expensive trap to handle your condensation.

It's different with the American Ideal. Here the valve discharge orifice is much larger than any other trap having the same size inlet. Consequently you can use a smaller trap of the American Ideal *continuous flow* type than of other makes.

AMERICAN IDEAL STEAM TRAP

is the only trap with a powerful enough leverage to operate a valve with such a large orifice.

Because of this powerful leverage, we can use a heavy float of *thicker, stronger* seamless copper which will withstand a pressure of 600 lbs. to the square inch. This heavier float eliminates the danger of the float collapsing and enables us to guarantee it for the life of the trap.

These features, and others like the reversible and renewable Monel metal valve stem, renewable phosphor bronze seat, water sealed valve, etc., make the American Ideal the most efficient and durable as well as the cheapest trap on the market.

Write for interesting booklet, "A Steam Trap Catechism."

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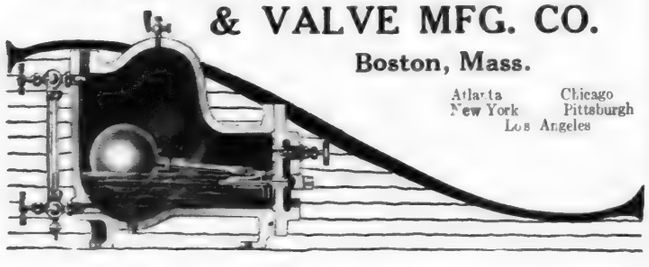
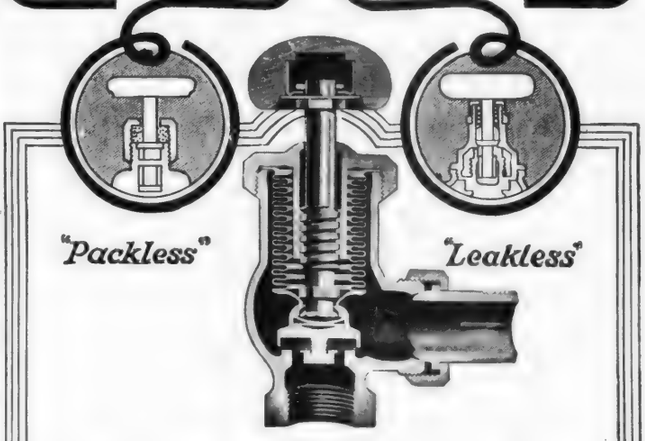


SYLPHON

The Valve without a Fault.

Composition Rings and Cotton wick packing are used in this so-called Packless Valve. The rings soon wear out causing the valve to leak.

In this so-called Packless Valve ground joints take the place of the ordinary cotton-wick packing. These soon wear down thru friction, making it necessary to renew them at intervals.



Years of bitter experience have taught reputable Architects and Contractors that it does not pay to use a cheap, inferior radiator valve that requires packing and adjustment every year or so. There are many so called "Packless" valves on the market. The majority of these have one or more of the disadvantages in construction as shown in the circles on this page. The SYLPHON PACKLESS radiator valve is the only valve that has NO PACKING—NO COMPOSITION DISCS, and NO METAL RINGS. There are no rotating or sliding parts exposed to steam or water and the valve CANNOT LEAK. The SYLPHON PACKLESS radiator valve permanently and positively insures the owner against all renewal expense. The valve is known as our "Government Pattern" and has been approved by the United States Government.

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Therefore its air displacement capacity is positive, dependable, *measurable and guaranteed.*

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Allen Air-Turbine Ventilators are unaffected by snow, ice, sleet or rain. *They are positively leak-proof*, and the powerful, continuous upward suction flow of air make *down drafts impossible.*

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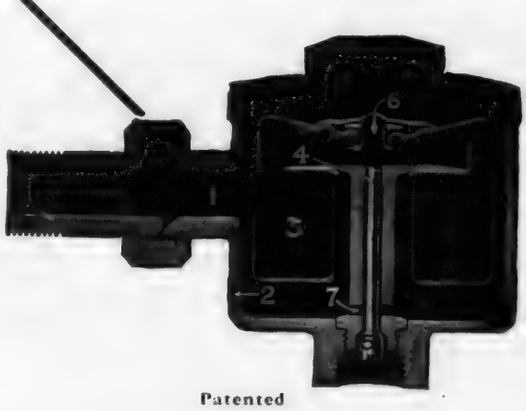

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THE McDonald Under-Seat Valve is the only valve of its kind on the market. The principle of operation is positive and noiseless. It gives perfect service on any radiator on a two-pipe heating system and under any ordinary pressure up to ten pounds. Handles and discharges a much larger quantity of water than any other trap or valve of equal size. Self-cleaning. Carries away all scale. Entire inside instantly removable by loosening cap. Saves every ounce of steam. Its economical features are greatly appreciated by the building owner.

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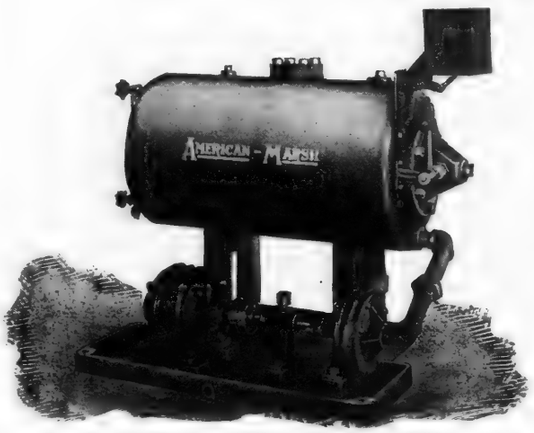
American-Marsh Pumps

for Heating Systems



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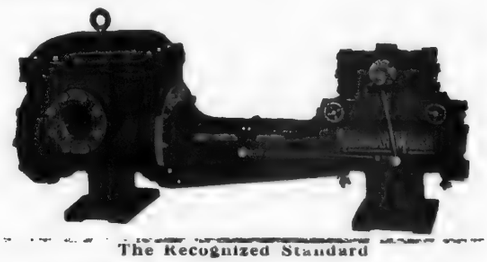

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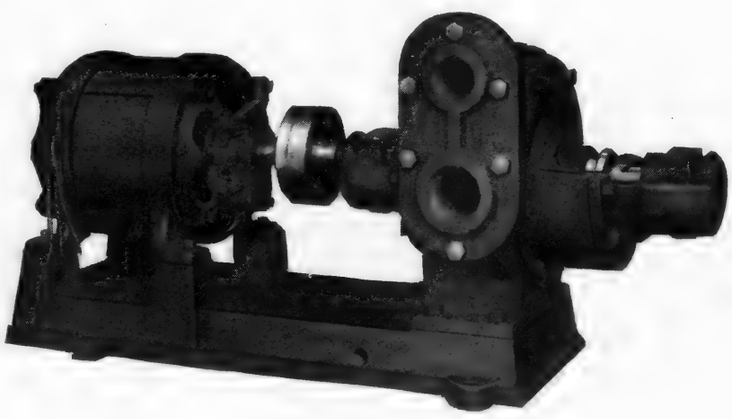

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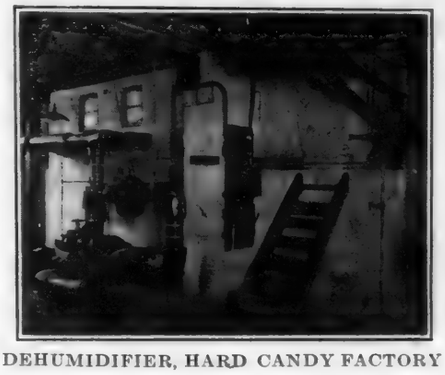

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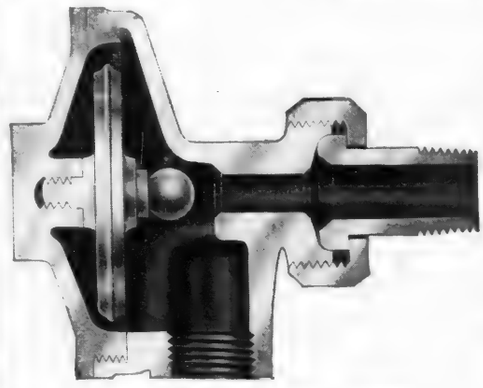

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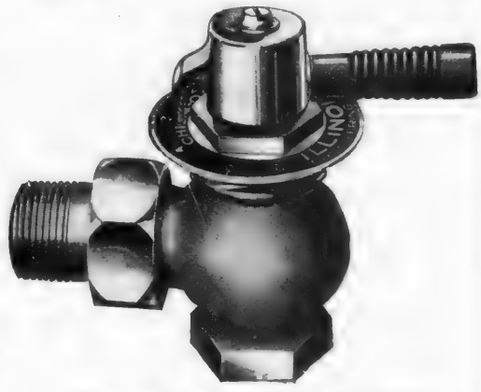

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Positive operation and long life.

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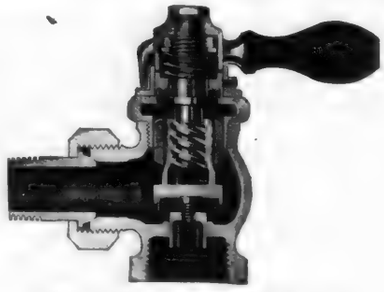

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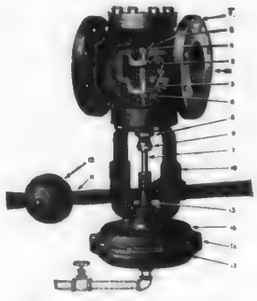

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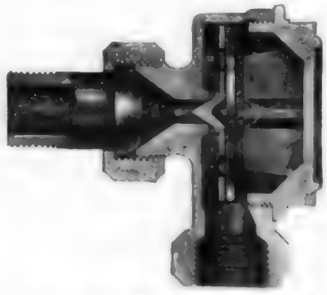
Full Area—Accessible



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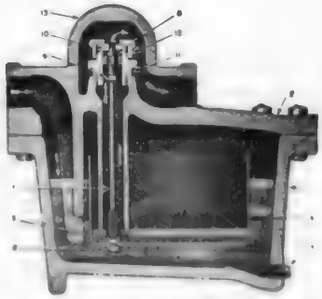

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Reversible Seat—Accessible

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The Heating and Ventilating Magazine

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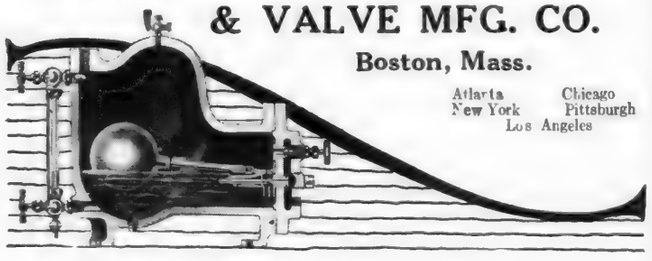

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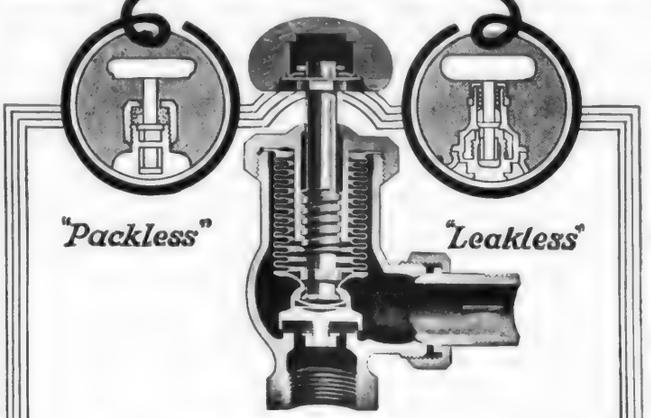
Composition Rings and Cotton wick packing are used in this so-called Packless Valve. The rings soon wear out causing the valve to leak.

In this so-called Packless Valve ground joints take the place of the ordinary cotton-wick packing. These soon wear down thru friction, making it necessary to renew them at intervals.



Years of bitter experience have taught reputable Architects and Contractors that it does not pay to use a cheap, inferior radiator valve that requires packing and adjustment every year or so. There are many so called "Packless" valves on the market. The majority of these have one or more of the disadvantages in construction as shown in the circles on this page. The SYLPHON PACKLESS radiator valve is the only valve that has NO PACKING—NO COMPOSITION DISCS, and NO METAL RINGS. There are no rotating or sliding parts exposed to steam or water and the valve CANNOT LEAK. The SYLPHON PACKLESS radiator valve permanently and positively insures the owner against all renewal expense. The valve is known as our "Government Pattern" and has been approved by the United States Government.

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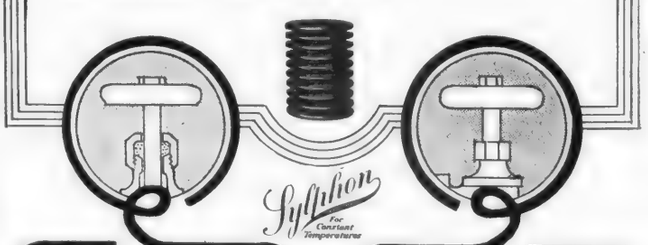

In this type of valve cotton-wick packing is used which necessitates repacking every eight months or so.

Compare the beautiful rosewood, non-burning handle of the Sylphon Valve with this valve where exposed metal places one in danger of having the hand burned.

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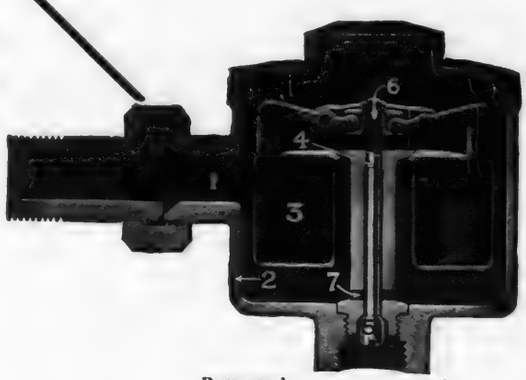

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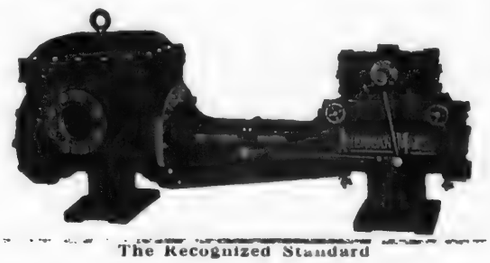

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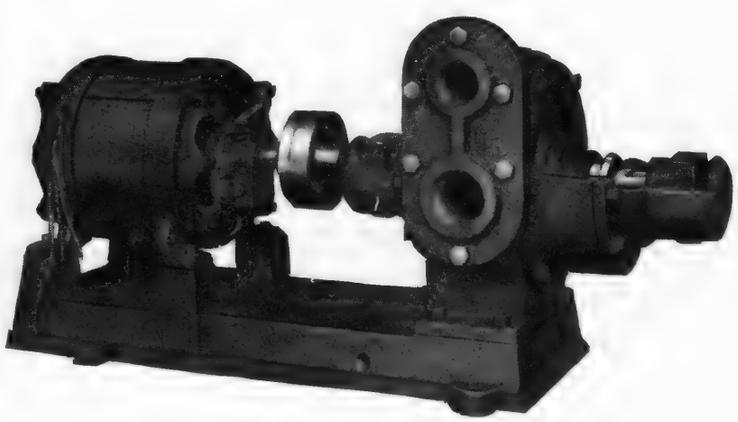

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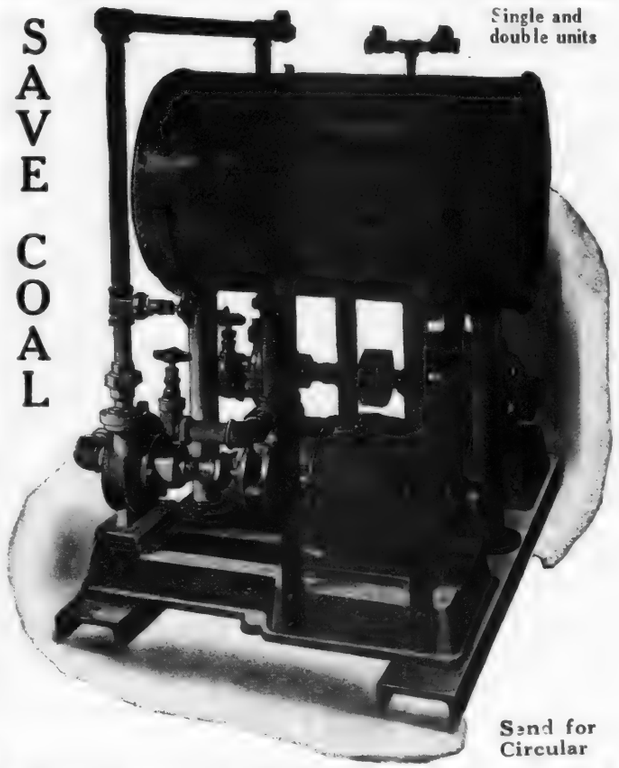

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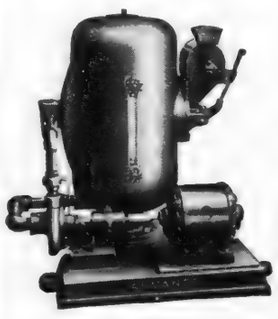

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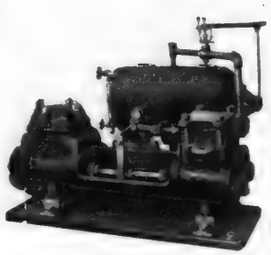

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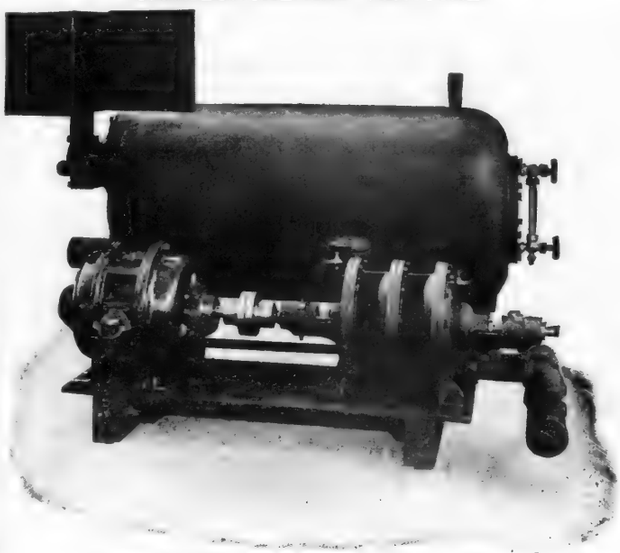

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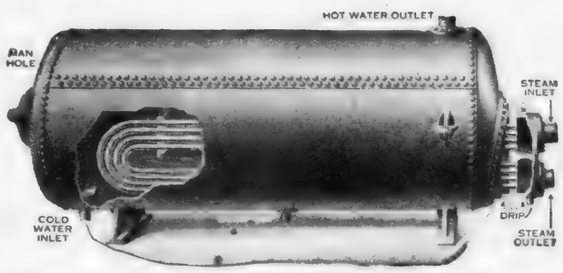

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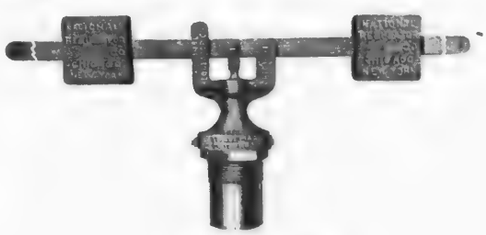

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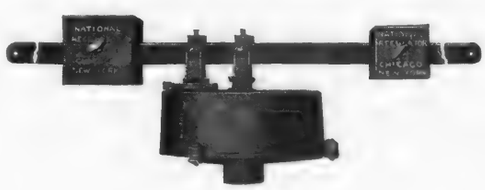

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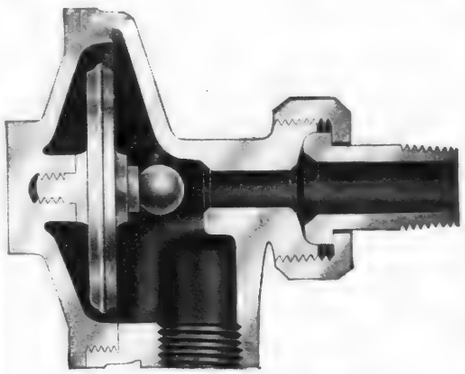

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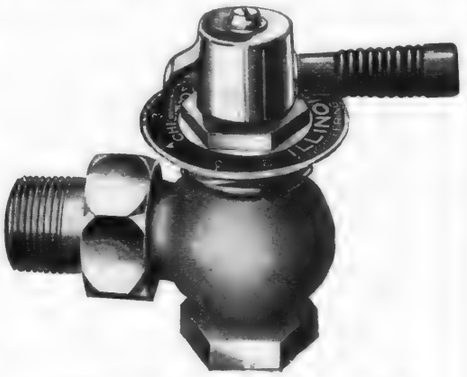

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Positive operation and long life.

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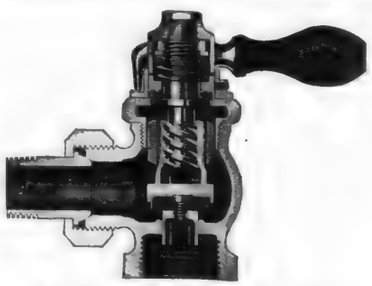

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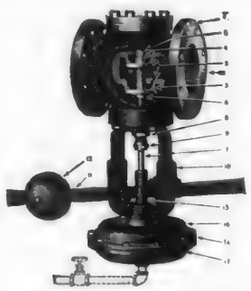

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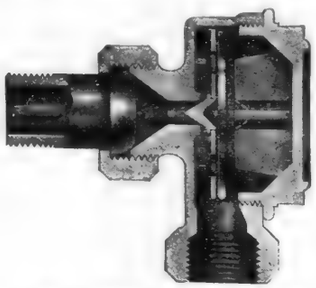

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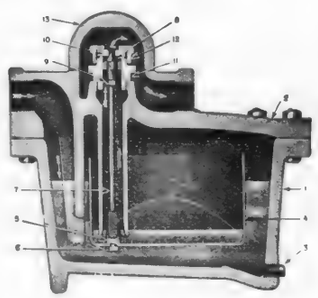

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Reversible Seat—Accessible

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The Heating and Ventilating Magazine

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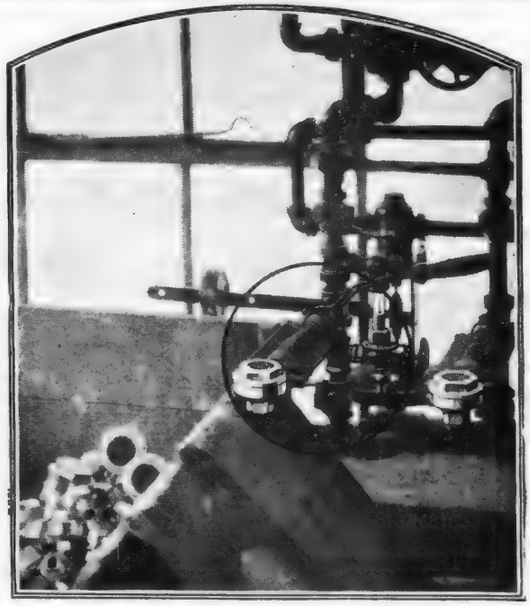
When the Testing Stand at the factory puts the O. K. on a trap, that trap is ready for business. Installed on a radiator, it will stop the steam but pass the air and water. It will keep on doing this for—well, we don't know for how many years.

Many of the original traps after seventeen years of continuous service are still operating satisfactorily and with promise of working indefinitely. Mechanically the Dunham Trap is better today than it ever was.

The principle of operation is the same today as when the trap entered the Patent Office. Of this fact, we are rather proud. To you, it will perhaps indicate that Dunham Standards are stable, and of known value, and can be depended upon to serve you and your customers.

We believe that you can profitably co-operate with Dunham Service. May we explain?



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Radiator Traps

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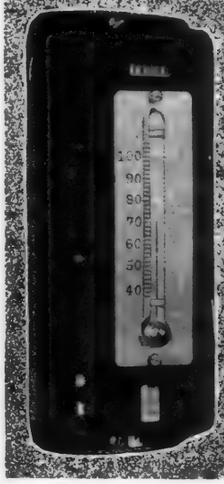
SUPERIOR HEAT - CONTROL



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The Only System Constructed of Nothing but Metal

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A MONTHLY JOURNAL OF ENGINEERING PROGRESS

MAY, 1921

HOW HEATING AND VENTILATION IS TAUGHT AT PURDUE UNIVERSITY

Outline of the Course of Instruction, Together with Some of the Typical Data Sheets Used

BY R. W. NOLAND, M. E.,
Professor of Heating and Ventilation.

I.

DATA sheets, of which the accompanying are typical, have been used with marked success in the course of heating and ventilation at Purdue University, Lafayette, Ind. This course is administered as an option to senior students in the School of Mechanical Engineering.

While some of the sheets are original with the writer, others simply represent a compilation of available data in a form convenient for the use of the student and engineer.

GENERAL INSTRUCTIONS FOR THE PREPARATION OF — PLANS AND SPECIFICATIONS.—

A. PLANS.—

EXTENT OF PLANS.

Complete Plans showing the Heating and Ventilating equipment should always be made. These should be separate drawings from the general architectual Plans in order to avoid confusion and for the convenience of the engineer, bidder and contractor.

SCALE.

The same scale should be used on the drawing as is used by the architect. The scales ordinarily used are:-

For General Plans.

1/8" = 1'-0
1/4" = 1'-0

For Details.

1/4" = 1'-0
1/2" = 1'-0
3/4" = 1'-0
1" = 1'-0

NECESSARY BUILDING PLANS.

In laying out or tracing the Plans of the building to be heated, prior to laying out the Heating or Ventilating equipment, show only the main architectural features of the general Plans and lay these in with very light lines, so that the equipment, when it is laid in later, will stand out clearly from the building outline. Plans should be laid out on Tracing cloth or Tracing paper.

METHOD OF LAYING OUT THE HEATING AND VENTILATING EQUIPMENT.

Match up the tracings of the floor plans in order and fasten along the top edge to the Drawing Board. Ordinarily the Basement Plan is placed on top. With tracings arranged in this manner it is easy to work from one floor to another. In laying out the Equipment the structural and architectural requirements must be kept constantly in mind and great care must be exercised to avoid interference or conflict with the same. While nearly all Equipment is shown in plan only, it is necessary to always keep the vertical section in mind. In any case of uncertainty as to vertical clearances or to more clearly show Equipment which cannot be shown well in plan, a detailed elevation should be made of the part in question. In general the Plans should clearly show all Equipment to scale and properly located. Use sufficient notes on the Plans to make them absolutely self-explanatory.

B. SPECIFICATIONS.

Plans and Specifications are supplementary to each other. Therefore every set of Plans must be accompanied by a carefully prepared specification which meets all legal requirements.

The sheets do not displace reference books but are used as a supplement thereto. The student is not required to purchase a text-book, but copies of the works of all recognized authorities are available in the design room.

A major portion of the work consists in designing and laying out heating and ventilating plants, using actual plans. Some of these plans have been reduced to a small scale and appear in the data sheets. When a student is assigned to one of these jobs he reproduces the floor plans on tracing cloth or paper to a suitable scale and lays out the job thereon. Specifications and estimates are worked up to accompany the plans.

It is the intention to make this course as near like work in an actual engineering office as school conditions will permit. As a beginning, the student is assigned to one of the simpler plans and instructed to produce plans, specifications and estimates for a gravity warm-air furnace system, a gravity water heating system and some type of steam or vapor system.

In the latter part of the course he is instructed to prepare plans, specifications and estimates for an industrial plant, such as will be shown later. On this job he is given no advice or assistance whatever and it is up to him to select and design the system which he thinks is best suited to the job. Some very interesting and instructive results are obtained from this assignment.

The design course is accompanied by a lecture course in which all types of heating and ventilating plants are studied in their fundamental aspects.

HEAT TRANSMISSION OF BUILDING CONSTRUCTION.
VALUES OF THE FACTOR "K"

K = BTU Transmitted per Sq. Ft. per Hr. per degree difference in Temp.

Type of Construction	K
GLASS	
Single Glass, Tight	1.07
Single Glass, Medium	1.20
Single Glass, Loose	1.35
Single Glass, Weather Strip	.90
Double Glass, Storm	.52
Plate Glass	.74
Vault Glass, Sidewalk	1.46
Single Skylight	1.12
Double Skylight	.57
Single Monitor	1.10
DOORS	
Single Door 1¾" Thick	.44
Single Door, Weather Strip	.34
Double Door, Storm	.27
WALLS	
Frame, Sheathing Paper Clapboards, no Plaster	.27
Frame, Clapboard Plaster	.45
Frame, Clapboard Paper Plaster	.31
Frame, Clapboard Sheathing Plaster	.29
Frame, Clapboard Sheathing Paper Plaster	.24
Frame, Clapboard Paper Sheathing Back-Plaster and Plaster	.21
Brick, Plain 4"	.52
8"	.40
12"	.30
16"	.25
20"	.22
Brick, Plastered 4"	.49
8"	.38
12"	.29
16"	.24
20"	.21
Brick, Furred and Plastered 4"	.29
8"	.27
12"	.24

Type of Construction	K
WALLS	
Brick, Furred and Plastered 16"	.21
20"	.18
Brick, Hollow and Plastered 8"	.25
12"	.22
16"	.19
20"	.17
Brick Veneer, Sheathing, Air Space, Plaster	.17
Brick Veneer, Shething, Air Space, Back Plaster	.14
Marble or Granite, Solid, Furred and Plastered 12"	.40
18"	.34
21"	.32
24"	.30
30"	.27
36"	.24
40"	.22
Marble or Granite, Hollow, Furred and Plastered 12"	.30
18"	.21
21"	.20
24"	.19
30"	.17
36"	.16
40"	.15
Sandstone or Concrete, Furred and Plastered 12"	.47
16"	.41
20"	.37
24"	.33
33"	.28
40"	.24
Limestone, Furred and Plastered 12"	.52
16"	.46
20"	.41
24"	.38
32"	.32
40"	.26

HEAT TRANSMISSION OF BUILDING CONSTRUCTION.
VALUES OF THE FACTOR "K"

K = BTU Transmitted per Sq. Ft. per Hr. per degree difference in Temp.

Type of Construction	K
PARTITIONS	
4" Studs, Lath and Plaster one Side only	.54
4" Studs, Lath and Plaster Both Sides	.34
Solid Plaster 3"	.50
2" Pine Board	.28
1" Wood	.41
FLOORS	
Wooden Beam, Planked over Mill Construction	.13
Single ¾ Floor, no Plaster Beneath	.36
" " " , " "	.25
Double ¾ Floor, no Plaster Beneath	.26
" " " , " "	.21
Cement Floor, No Wood above	.29
or Tile, " "	.14
Dirt	.13
FLOORS AND CEILINGS	
Plaster Ceiling, Air Space Filling and Soft Wood Floor, Cold air above	.10
Same, Cold air under	.05
Same, Double Floor, Cold air above	.09
" " " , " " under	.05
Reinforced Concrete Ceiling with double Floor	.24
CEILINGS	
Wooden Beams, Planked over Mill Construction	.19
Joists with Single Floor	.40
Lath and Plaster, No Floor above	.43
" " " Floor above	.28

Type of Construction	K
ROOFS	
Sheet Iron	1.26
Corrugated Iron, Without Boards	1.81
Slate on wood Framing	.83
" " " 1" Boards	.39
Iron on tight wood Sheathing	.28
Tar Paper over 1" Boards	.44
Tile, no boards under	1.12
6" Hollow Tile covered with 2" Concrete, Tar and Gravel	.40
Reinforced Concrete without air Space	.57
Shingle, no Sheathing	.58
Shingle, Sheathing	.34

—HEAT LOSSES FROM BUILDINGS.—

DEFINITION:—

Heat Losses are expressed in BTUs lost per hour. Heat Losses are as a rule computed for extreme weather conditions.

METHOD OF COMPUTATION.

RADIATION LOSSES.

(Sq. Ft. of Glass) x (K. for Glass) x $(t_1 - t_o)$ = HL. thru G in BTU
(Sq. Ft. of Wall) x (K. for Wall) x $(t_1 - t_o)$ = HL. thru W in BTU
(Sq. Ft. of Roof) x (K. for Roof) x $(t_1 - t_o)$ = HL. thru R in BTU

And so on until each exposed Surface has been accounted for.

CONVECTION LOSSES.

(Cubic Contents of Room in Cu. Ft.) x (Changes per hr. due to leakage) x $\left(\frac{t_1 - t_o}{55}\right)$ =

HL. due to Convection in BTU

(1) TOTAL CALCULATED HEAT LOSS = SUM IN ——— BTU
(2) Add percent for EXPOSURE LOSSES = ——— BTU

TOTAL HEAT LOSS = (1) + (2) = ——— BTU

SYMBOLS AND FACTORS.

K = Unit Factor of Heat Transmission = BTU transmitted per Sq. Ft. per Hour per degree difference between the two sides of the Surface. (See Tables)

t_1 = Temperature in Room or Building.

t_o = Temperature outside Room or Building.

Factor 55 is obtained as follows;

Sp. Vol. of air at 70° F, Bar. 29921 = .07495
Sp. Heat of air at constant Vol. = .23751

$\frac{1}{.23751} \times \frac{1}{.07495} = 56+$ = Deg. F 1 BTU will raise 1 cu. Ft. of air.

For average conditions 55 is used.

EXPOSURE-LOSSES.

The following Values represent average practice;

Add to CALCULATED HEAT LOSS,

5 to 10%, East or West Room moderately exposed.
10 to 20%, N, NE or NW Room heavily exposed.
20 to 50%, Rooms heated only periodically.

DEFINITION OF EXPOSED SURFACE.

Exposed Surface is any surface exposed to a lower temperature on one side than the other. In Heat Loss Computations it is evident that calculations will not be made for any Surface that is not exposed Surface.

—RADIATION—

NOMENCLATURE:—

K = Unit Transmission Factor For Radiation for a specific condition = BTU transmitted per sq. ft. of Radiator surface Per Hour, Per degree difference in Temperature

HL = Heat Loss in BTU Per Hour.

t_1 = Temperature of Steam or Hot Water in the Radiator

t_2 = Required Room Temperature.

$\oint$ = Square Feet of Radiation.

DIRECT RADIATION.

(1) GENERAL RULE:— $\frac{HL}{K(t_1 - t_2)} = \oint$

(2) FOR CAST IRON STEAM RADIATION, with Steam at 2 lbs Gage, 70° Room Temp, (1) becomes;

$\frac{HL}{1.65(220-70)} = \frac{HL}{247+}$ use $\frac{HL}{240}$

(3) FOR CAST IRON HOT WATER RADIATION, average Water Temp 170° 70° Room Temp, (1) becomes;

$\frac{HL}{1.65\,(170-70)} = \frac{HL}{165} = \oint$

(4) FOR STEAM PIPE COILS, with Steam at 2 lbs. Gage, 70° Room Temp., (1) becomes;

$\frac{HL}{2(220-70)} = \frac{HL}{300} = \oint$

(5) FOR HOT WATER PIPE COILS, average Water Temp. 170°, 70° Room Temp., (1) becomes;

$\frac{HL}{2(170-70)} = \frac{HL}{200} = \oint$

IF RADIATION IS PLACED OVERHEAD, add 15% to values obtained by above rules.

IF CONDITIONS VARY APPRECIABLY FROM THE ABOVE substitute in (1)

DIRECT-INDIRECT RADIATION.

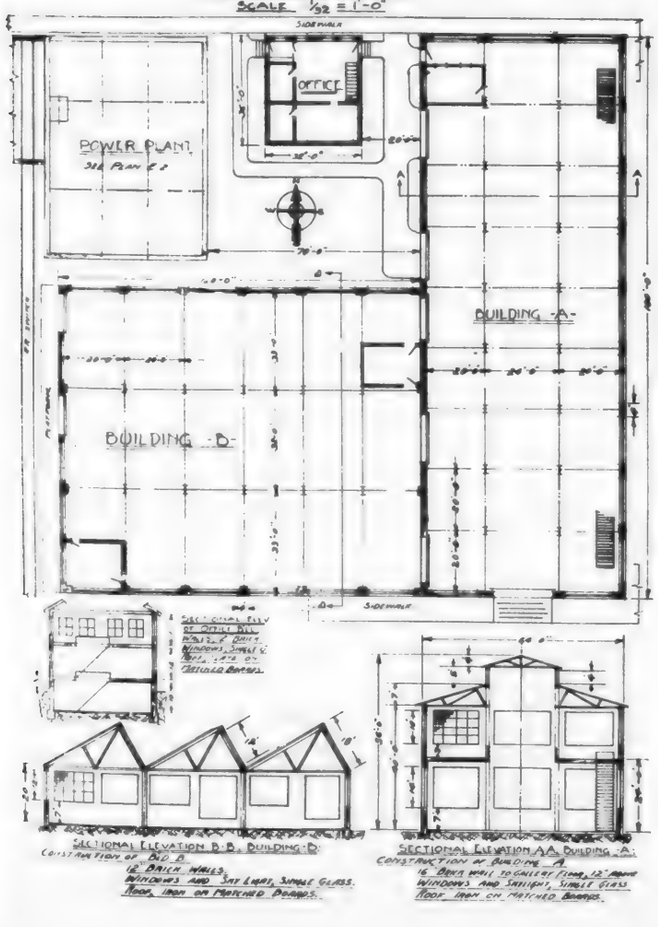
It is Common Practice to Compute Direct-Indirect Radiation as Direct and add 25% to the result thus obtained.

INDIRECT RADIATION.

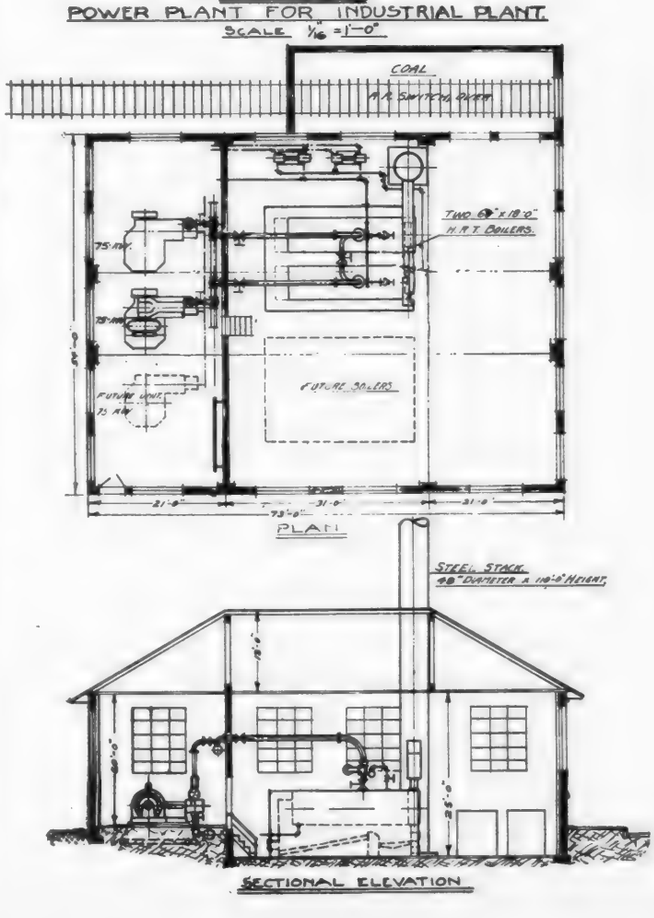
GRAVITY TYPE:— It is common practice to compute as Direct Radiation and add 50% to the result.

BLOWER COILS:— Use Manufacturer's Tables).

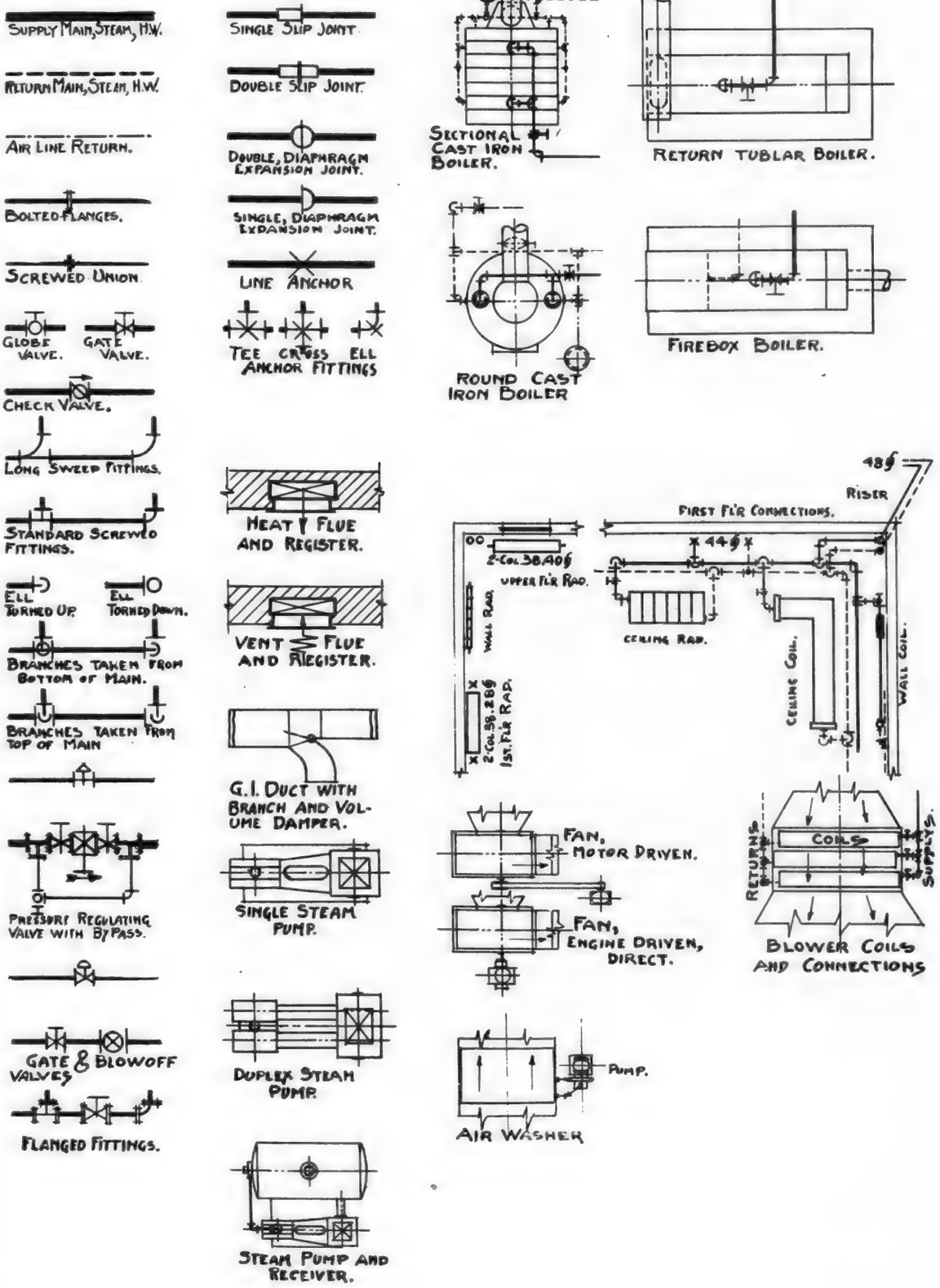
— PLAN E 1 —
INDUSTRIAL PLANT
SCALE 1/32 = 1'-0"



— PLAN E 2 —
POWER PLANT FOR INDUSTRIAL PLANT.
SCALE 1/16 = 1'-0"



DRAFTING ROOM CONVENTIONS.



AIR AS A CONVEYOR OF HEAT

With Notes on Principal Sources of Waste Incident to Such Use, and Methods of Reducing that Waste

BY S. HOMER WOODBRIDGE.

HEAT may be, and commonly is, generated in a locality other than that in which it is used. It is then conveyed in some form of vehicle from the place of its generation to that of its application. The vehicles more commonly employed are air, water, steam or electricity. Other types of vehicles are possible, and sometimes preferable, as also other methods of transportation than flow.

Of the vehicles named the more inevitably wasteful are air and electricity. This paper deals with air as a thermal vehicle; and its purpose is to note the principal sources of waste incident to such use, and certain methods of reducing that waste.

PART OF HEAT USED IN EXPANDING AIR.

In the first place, it should be noted that only part of the heat imparted to free air is effective in raising the temperature of that air. Nearly 30% of that heat is expended in the work of expanding the volume of the affected air, and but little more than 70% of the heat used appears in the rise of temperature. The exact proportions of heat expended in those two processes may be computed in the following manner:

A cube of dry air 10 ft. × 10 ft. × 10 ft. at 0° F. and 14.7 lbs. pressure per square inch weighs 86.354 lbs. The absolute temperature of that air is 459.4° F. Imagine that air confined within a chamber of the dimensions given, except that the top be open and that the chamber have a height of 20 ft. Let heat be imparted to that body of 1000 cu. ft. of air until its absolute temperature shall be 459.4 × 2 = 918.8°. The volume of that air will then become 2000 cu. ft. The expansion will be upward 10 ft., against a pressure represented by 10 × 10 ×144 × 14.7 = 211,600 lbs.

The mechanical work done in the process of that expansion is then 211,600 × 10 = 2,116,000 ft. lbs.

The mechanical equivalent of heat has been found (by Rowland, Johns Hopkins) to be 778 ft. lbs. equal 1.00 B. T. U. Therefore, the number of B. T. U. expended in doing the work of that expansion is 211,600 ÷ 778 = 2719.79.

The total heat expended in doing that work of expansion, and in raising the temperature of the air through 459.4°, is found by multiplying the weight of air by the rise of temperature, and that product by the specific heat of dry air,—0.2375:

86.354 × 459.4 × 0.2375 = 9421.86 B. T. U.

Therefore 9421.86—2719.79 = 6702.07, represents the B. T. U. appearing in the rise of temperature.

It follows that 6702.07 ÷ 9421.86 = 0.7113, makes 71.13 the per cent of the total heat imparted to free air affecting temperature, and that 2719.79 ÷ 9421.86 = 28.87, makes 28.87 the per cent of that heat which is expended in the work of expansion.

It therefore appears that if the air had been heated from 459.4° absolute, to 918.8° in a confining chamber preventing expansion, it would have required but 71.13% of the heat necessary to effect the same rise of temperature in the same weight of free air.

The ratio of the heat required to raise the temperature of any given weight of air under constant volume from t° to t′° to the heat required to raise the same air through the same temperature range under constant pressure is therefore 1.00 to (1.00 ÷ 0.713) = 1.406.

The value corresponding to the above figures, as given in texts of older, and even some of more modern, origin, are at more or less variance with those here derived, because the absolute zero employed in the computations by which the formerly accepted figures were derived ranged as low as 454.4°, the normal atmospheric pressure as high as 15 lbs., and the mechanical equivalent as low as 774 ft. lbs.

The practical and significant value of the data above presented appears in the demonstration they afford that approximately 29% of heat yielded to free air for its warming is ineffective in that process because expended in the work of expansion against pressure, and is, therefore, lost to heating effect, 71% of heat imparted to such air warming it, and 29% expanding it. In other words, only 71% of all heat yielded to free air is available for warming effects, and 29% for ventilating work.

DRAFT THROUGH HEATED FLUES CAUSED BY WEIGHT DIFFERENCE, NOT TEMPERATURE DIFFERENCE.

It therefore appears that when air is heated, by whatever means or process, for ventilating purposes, 71% of the heat so applied is ineffective in that work, for it is not temperature difference, but weight difference, which produces draft through heated flues. In this fact is to be found one of the causes of the costliness of effecting ventilation by means of heated shafts. Out of every ton (2000 lbs.) of coal burned for imparting heat to free air 580 lbs. are ineffective in air warming, and 1420 lbs. are equally ineffective in the application of that fuel quantity to ventilating service.

Conversely, when heated air is cooled, heat is yielded by the cooled air in two ways; first, directly by the cooling process; secondly, indirectly by the process of contraction, the heat yielded in the process of contraction being equal to that imparted in the process of expanding the same air through an equal change of volume. The increased temperature in cold and rarefied air about high mountain peaks when borne down by air currents on to the floor of deep valleys is due to heat yielded in the process of contraction. The same is true of the scorching temperatures attending air compression in mines caused by gas explosions in localities remote from the places where the temperature rises occur:

PRINCIPLE OF WARMING BY HOT AIR.

If the volume of a given body of dry air at 70° F. be 10,000 cu. ft., at 150° the volume becomes 11511 cu. ft. If a total of 14,245 B. T. U. be imparted to the air in the process of producing that rise in temperature, then 10114 B. T. U. will be operative in producing that rise, and 4131 B. T. U. will disappear in the work of expansion. If that heated air be then cooled to 70°, both those thermal quantities will be yielded back. It is in this way that warming by hot air is effected. Consequently, if the initial temperature of the air used is 70°, and the maximum temperature to which it will be raised is at any point above 70°, and the final temperature to which it is cooled is 70°, or below, there is no thermal loss. When, however, the initial temperature is below the final, there is a thermal loss proportional to the difference between the two temperatures. If, in the case just cited, the initial temperature be 0°, and the final 70°, the total thermal input to the vehicle of 10,000 cu. ft. of air at 0°, when raised to 150° is 30,780 B. T. U., of which 21,852 B. T. U. appears in the temperature rise, and 8,928 B. T. U. disappears in expansion work. When that air at 150° cools back to 70°, 11665 B. T. U. are yielded by the process of cooling, and 4761 B. T. U. by that of contraction, a total yield of 16416 B. T. U., against the 30780 B. T. U. expended, involving a loss of 14362 B. T. U. or 46.68%

of the total heat expended in the process, because the vehicle employed has discharged only 53.32% of its thermal load.

VARIOUS WAYS OF SUPPLYING THERMAL QUANTITIES TO A GIVEN BUILDING.

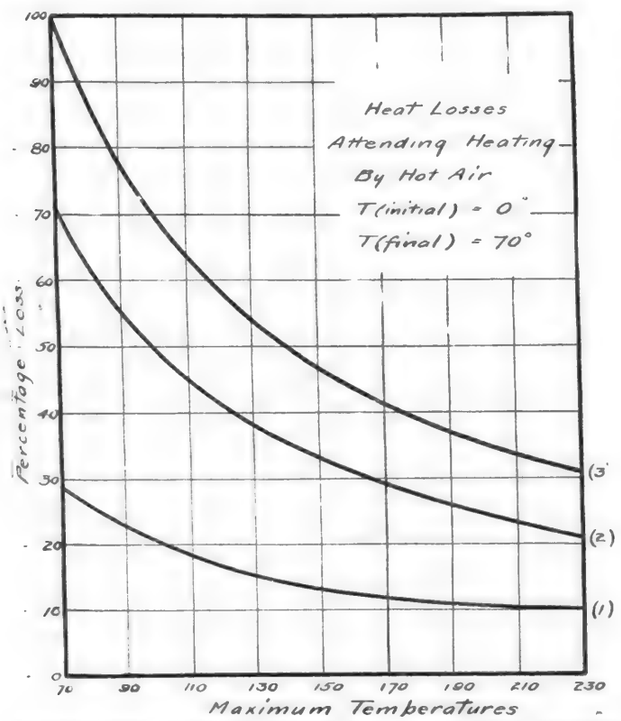
Let a building require the thermal quantity in zero weather, 16416 B. T. U. per minute, the heating work can be done in the several ways indicated by the following table.

5000	cu.	ft.	of	air	initial	0°	maximum	230°	final	70°
6000	"	"	"	"	"	0	"	203.3	"	70
7000	"	"	"	"	"	0	"	184.3	"	70
8000	"	"	"	"	"	0	"	170.0	"	70
9000	"	"	"	"	"	0	"	158.9	"	70
10000	"	"	"	"	"	0	"	150.0	"	70
11000	"	"	"	"	"	0	"	142.7	"	70
12000	"	"	"	"	"	0	"	136.7	"	70
15000	"	"	"	"	"	0	"	123.3	"	70
20000	"	"	"	"	"	0	"	110.0	"	70
25000	"	"	"	"	"	0	"	102.0	"	70
50000	"	"	"	"	"	0	"	886.0	"	70
100000	"	"	"	"	"	0	"	78.0	"	70

The larger the air quantity used the lower the maximum temperature required becomes; or, the larger the thermal vehicle, the lighter the thermal load per unit of conveyance capacity, and the larger becomes the wastage.

PERCENTAGE OF WASTE WITH AIR AS A HEATING MEDIUM SHOWN GRAPHICALLY.

The graphical table, Fig. 1, shows the percentage of waste attending the method of heating by air as a thermal vehicle, the initial temperature being 0°, the final temperature, as that of the air within a building, being 70°, and the maximum temperatures being those indicated on the abscissa line; and in which



PERCENTAGE OF WASTE WITH AIR AS A HEATING MEDIUM

Curve 3 indicates the total wastage.

Curve 2 indicates the wastage incident to raising the air temperature from 0° to 70°.

Curve 1 indicates the wastage attending the work of expansion.

The table makes it manifest that economy favors a use of a minimum air quantity raised to the highest permissible temperature.

ECONOMY OF THROTTLING THE DAMPERS IN COLD-AIR BOXES.

Here is found, and in the curves is made evident, the commonly unperceived, but correct, logic inherent in that use of the dampers of cold-air boxes by the domestic economist who, with the low dropping of outside temperature, throttles the intake air way to his furnace, finding by experience that the greater the cold and the less the air, the higher the heating effect.

FIGURING PERCENTAGES OF LOSSES FOR VARIOUS CONDITIONS.

The percentage of losses when air is heated for warming purposes from any initial temperature T′ to any maximum temperature T″, and cooled to 70° may be found by use of the formula

$$\frac{70 - T'}{T'' - T'} = \text{per cent loss.}$$

Similarly, for any initial temperature T′, and any maximum temperature T″′, and the final temperature T″ the percentage of loss may be found to be

$$\frac{T'' - T'}{T''' - T''} = \text{per cent loss.}$$

Thus let T′ = 15, T″ = 65, and T″′ = 125°, the percentage of loss is found to be 45.45.

HOW THIS APPLIES TO DIRECT RADIATORS.

When heating is done by the method of so-called "direct radiation," the losses due to the causes above described disappear by as much as the temperature of the air moving toward, for flow over, the radiators approaches the lowest temperature obtaining in the enclosure. The heat expended in expanding the warmed air produces the currents which move the ambient air toward and over, and the heated air away from, the radiators to all parts of the room, so affecting both the rate of heat yield from the radiator and the diffusion of heat throughout the enclosure. Having served these several and indispensable functions, the motile heat then passes from the air and contributes to the heating process. Hence the relative economy of heating by the "direct" method.

EXPLANATION OF HIGHER COSTS OF INDIRECT METHOD.

The higher costs of the indirect method of heating are chargeable to the benefits of ventilation, and become necessary when ventilation is required for the maintenance of hygienic conditions within inhabited enclosures. Because of some physical and sensibly perceivable changes produced in certain organic contents of air when brought into contact with heated surfaces, some professional, and other legislative, authorities have established regulations aimed to prevent the use of a maximum air temperature of more than 8° to 10° above an intended final temperature. The rules governing the procedures for warming and ventilating the English Houses of Parliament have been very strict in reference to this matter, regardless of the thermal waste entailed.

The so-called "indirect" heating employs convection only, eliminating that direct radiation which contributes, roughly, from 25% to 50%, according to radiator construction and exposure, of the total heat yield from radiators as ordinarily exposed in rooms. "Indirect" heaters are, therefore, inappropriately termed 'indirect radiators," since radiation as affecting the heating process is suppressed. Such heaters are in reality convectors. The direct radiator is a combined convector and radiator.

The convector may be used in a manner to produce no more wastage of heat than the direct radiator. When the air passed through the convector is supplied to it by rotation, rather than by inflation currents, the complete thermal yield is effective in the heating process because the final temperature falls to the same point as the initial temperature.

Hence the economic value of maintaining the warmth of many types of buildings by the convector rotation method where for any reason direct radiation is undesirable.

In the June issue Professor Woodbridge will illustrate the advantages of the rotating method of heating by air in such structures as churches and schools, as well as the advantageous application of the rotating method in large enclosurers such as the great sheds housing extensive manufacturing equipments.

HEATING AND VENTILATION OF PAPER MACHINE ROOMS

An Analysis of the Problem, Showing the Need of Adequate Ventilation Together with Descriptions of Systems in Use and Proposed

By EDWARD A. RYAN

(Abstract of paper read before the Montreal Branch, The Engineering Institute of Canada, November, 18, 1920, and republished by permission of the Institute.)

(*Concluded from April Issue.*)

AS regards the condition of the air available for ventilating purposes, the following graphs should prove of interest. They have been compiled from records of the Meteorological Service of Canada, the observations having been taken at McGill University Station, Montreal, and they can be applied for work in that neighborhood or for places where the climate is much the same.

The graphs shown are for the year 1917 and they show the relation between the maximum relative humidities and the mean temperatures on the days corresponding to that on which the maximum relative humidities occurred, together with the monthly means of the mean daily relative humidities and temperatures.

In order to simplify calculations and show more readily the actual condition or absolute humidity of the air, a development of the former graph has been made showing the actual weight of vapor per pound of dry air corresponding to the above, and the same are shown directly underneath. It will be noted also that these latter graphs are accompanied by a line of saturation corresponding to the temperature applying for the particular points.

It is at once evident from this, the actual weight of moisture contained in the atmospheric air for the particular temperatures and that which it would contain if saturated. Obviously, the difference between these two is the weight of vapor that may be absorbed in the machine room, per pound of air delivered, provided it become fully saturated, its temperature be not raised and that it receive no vapor through leakage.

In practice, there will be a rise in temperature of the air, hence its capacity for absorption will be increased. There will also be an absorption of vapor due to leaks, depending on the arrangement and location of intakes, and also, if the principle of re-circulation be in use, there will be a reduction in the capacity for absorption. Furthermore, the air leaving the room will not be saturated.

From information gathered from operators in machine rooms, the periods of the year in which they experience the worst difficulties with condensation are, the spring and fall months—when heating is curtailed. If we examine the graphs the reason for this will be at once evident. It will be noted from the top graph that for the months of March, April, October and November, the monthly mean of mean daily relative humidities is generally higher, compared with the temperatures which are low, than in the other months. Since little heating is being done during this period, we have excellent cause for the production of moisture i. e. air having a minimum capacity per unit of volume for absorption and comparatively cold condensing surfaces in roofs and walls. Referring now to the second graph it will be noted that the actual moisture content of the air for these months, is practically the same for the maximum relative humidity recorded and the monthly mean of mean daily relative humidities. Note also how close these values are to the saturation point of the air. It must be borne in mind that in winter time, even though the air at the temperature of outdoors be near the dew point, this latter is raised when the air is heated and hence its capacity for absorption is raised. Note further that for the months of June and July the actual vapor content of the air was less per pound when the maximum relative humidity occurred than was the case for the monthly mean of mean daily relative humidities. This renders more evident the need of considering the air condition from its actual vapor content rather than to consider as extreme conditions those cor-

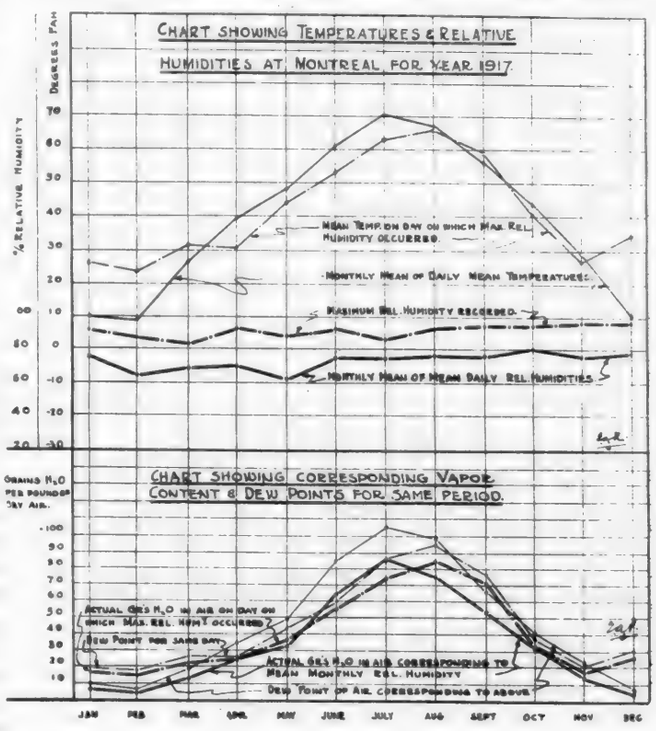
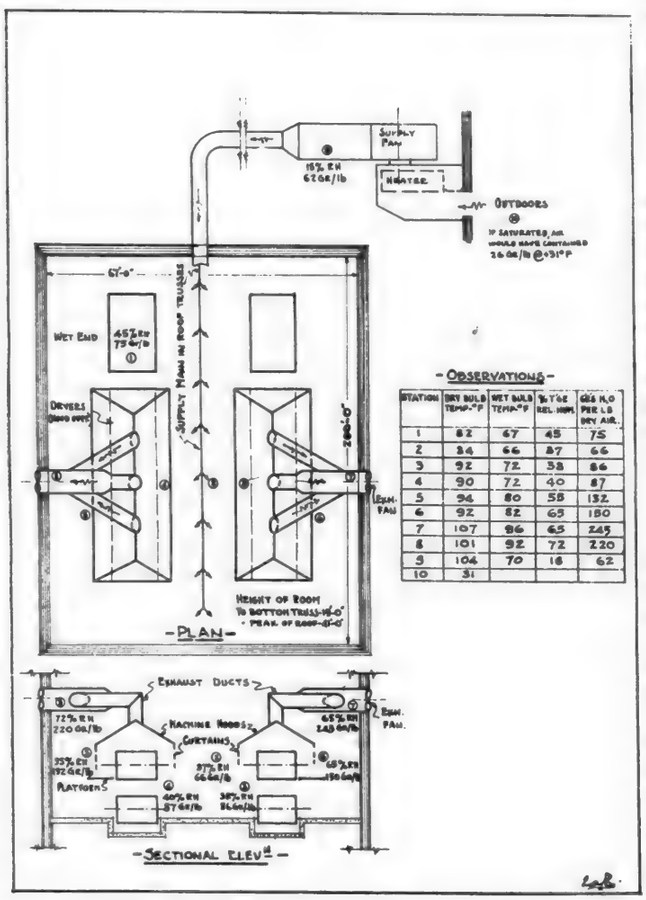


CHART SHOWING TEMPERATURES & RELATIVE HUMIDITIES AT MONTREAL FOR YEAR 1917
DEGREES FAH.
% RELATIVE HUMIDITY
MEAN TEMP. ON DAY ON WHICH MAX. REL. HUMIDITY OCCURRED.
MONTHLY MEAN OF DAILY MEAN TEMPERATURES.
MAXIMUM REL. HUMIDITY RECORDED.
MONTHLY MEAN OF MEAN DAILY REL. HUMIDITIES.
CHART SHOWING CORRESPONDING VAPOR CONTENT & DEW POINTS FOR SAME PERIOD.
GRAINS H2O PER POUND DRY AIR.
ACTUAL GRS H2O IN AIR ON DAY ON WHICH MAX. REL. HUMY OCCURRED.
DEW POINT FOR SAME DAY.
ACTUAL GRS H2O IN AIR CORRESPONDING TO MEAN MONTHLY REL. HUMIDITY
DEW POINT OF AIR CORRESPONDING TO ABOVE
JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC

FIG. 2—WEATHER CONDITIONS IN MONTREAL DURING 1917

responding to days upon which the maximum relative humidity occurred.

In order to show the actual conditions that may be expected in a machine room, the writer has prepared a drawing giving the results of tests made recently in a well known mill. These may be considered as a fair average of the conditions existing in most of the best ventilated mills to-day and incidently, there is room for improvement, as in this particular mill there were a number of days throughout the year when conditions were anything but good.



-OBSERVATIONS-

STATION	DRY BULB TEMP.-°F	WET BULB TEMP.-°F	% REL. HUM.	GRS H2O PER LB DRY AIR.
1	82	67	45	75
2	84	66	37	66
3	92	72	38	86
4	90	72	40	87
5	94	80	58	132
6	92	82	65	180
7	107	96	65	245
8	101	92	72	220
9	104	70	18	62
10	31			

FIG. 3—CONDITIONS DETERMINED BY TESTS IN PAPER MACHINE ROOM, DAILY OUTPUT 75 TONS

This drawing shows the general arrangement of fans, heaters, duct system, machines, hoods and the stations at which observations were taken, together with the dry bulb temperatures, relative humidities and vapor content of the air at the stations for the wet and dry bulb temperatures applying.

The points worthy of attention, as brought out by the above are:

That the air leaving the fan contains more moisture per pound than that corresponding to the quantity at saturation of the outdoor air at the temperature applying. The reason for this condition in the particular instance was that there were numerous openings in and around the fan casings and heaters through which moist air entered, and the arrangement of the discharge from the mill was such that a great quantity of the exhaust air was drawn into the supply system.

That the air absorbed 25 grains of moisture per pound in its passage from the duct outlets to a point midway up the length of the dryers.

That the dry bulb temperature of the air was increased in its passage over the dryers (Stations 4 to 8 and 3 to 7) by 11° and 15° respectively in the two machines. The wet-bulb temperature, as also the moisture content were consequently increased.

In making a decision on the quantity of air to be supplied, it is obvious that due consideration must be given to all the foregoing and to the average condition of the atmospheric air extending over a period of years. The supply of air constantly, to meet extreme conditions in any one year or month even, would hardly be justifiable. In the opinion of the writer, however, provision should be made in the fan drive so that the quantity may be varied by changing the fan speed to meet average conditions at any one period of the year. This can be readily done by using variable speed motors or by varying pulley sizes.

RECIRCULATION.

Recirculation of a portion of the total air handled in extremely cold weather seems to give quite satisfactory results and an appreciable reduction in steam consumption can be effected by this means. The reason for the absence of trouble is that when the temperature is low, the actual humidity of the air is also low—(See Fig. 2), and hence a unit quantity of air is capable of absorbing more vapor than under other conditions. It should be observed however that when recirculation is taking place, the quantity of air removed by the exhaust fan should be decreased in proportion to the amount of recirculated air, otherwise the room will be placed under a vacuum and an ingress of outdoor air will occur which is liable to produce bad results.

AUTOMATIC CONTROL.

As far as the writer is aware, there is no form of automatic apparatus on the market today that is practically adaptable for fulfilling the requirements as regards maintaining a desired degree of humidity in a machine room. The process in this class of building is the direct opposite of that for which automatic humidity control was developed—i. e. to keep the humidity up to a certain point, by the addition of vapor, as is done in textile mills, leather manufacturing plants, and in the ventilation systems of buildings. It is true that a very serviceable apparatus may be obtained to maintain a constant temperature, but what is required in a paper machine room is equipment that will control the temperature and air quantity so that an upper limit of humidity, that at which condensation occurs, will not be attained. If the air quantity be maintained constant and an attempt be made to control humidity by variation of the air temperature, there is grave likelihood of over or under heating, and, if it be attempted to maintain a constant room temperature, there will be no humidity control whatsoever.

There seems room therefore for the development of a practical piece of apparatus that will keep the humidity within the desired limits and also the temperature. Until this is done, the only solution is, intelligent hand control of operation.

FANS AND HEATERS.

For the supply system there are two types of fan to be considered—the multivane and the steel plate. The former has the advantage over the latter in that it is more efficient —consuming from 10 to 20% less power for the same capacity and furthermore the space requirements for fan and motor are less.

For the exhaust fans, the disc or propeller types can be used where the duty is a nominal one only i. e. of directing the flow of air and, where there is no appreciable resistance. When the latter condition is not fulfilled it is better to use the multivane or steel plate type.

Speed control is highly desirable for the reasons men-

tioned hereinbefore and variable speed motors offer the easiest solution.

As regards heater, we have the choice between pipe coil heaters and cast iron "Vento." The latter are preferable in that better steam circulation and drainage are obtained, they are much more readily relieved of air and their cost today is not more than the former type.

OPERATION.

The operation of the ventilating system requires but very little attention and satisfactory results will be obtained if intelligent care is taken. For the supply system, it is essential that the heaters be always free from air, that the condensation be promptly removed, that there be no leakages through which moisture may enter the fan suction chambers, and that the temperature and quantity of air be commensurate with the external conditons. Since automatic regulation is not available to perform the latter function to the required degree, it is advisable that temperature and humidity readings be taken at periodic intervals throughout the day, at various points in the room and of the outdoor air, and the fan speeds and air heating modified to suit. Records should be kept of conditions noted and the regulation performed, and, when these have extended over a period of a few years, a schedule of operation can be readily outlined to meet any conditions that are likely to arise.

POSSIBILITIES FOR IMPROVEMENT AND DEVELOPMENT.

As mentioned before, there is opportunity for improvement along the lines of humidity and temperature control, but the greatest field for development is in the way of improvement of overall economy by the utilization of the heat now thrown away in the discharged air and vapor from the machine room, the extent of this is hardly appreciated—it is enormous.

Let us consider the case of a machine room in which 150 tons of air dry paper are produced daily.

A rough figure for the quantity of air discharged per minute from the average mill of this size would be about 15,000 lbs. Its condition would probably be 75% relative humidity at 105° F.

The heat content of this mixture is the sum of the heat in the air plus that contained in the moisture—the latter in the state of vapor. This, expressed in terms of the B. T. U. above zero degrees Fahrenheit, is:

Per pound of dry air	25.37
Latent heat of vapor in 1 lb. of air @ 75% relative humidity	39.00
B. T. U. per pound of air @ 105° F. and 75% R. H.	64.37

Now suppose that this air be cooled to a temperature of 70° F. and that the contained heat be transferred to the incoming air or to water used in process work. At the latter temperature it would be saturated, the heat content being 33.51 B. T. U. per pound. The available heat becomes thus 30.86 B. T. U. per pound.

On our assumption of 15,000 lbs. of air per minute, for a 150-ton room, there becomes available therefore 15,000 × 30.86 = 464,000 B. T. U. per minute, or sufficient heat to raise the temperature of 15,466 lbs. of water per minute from an initial temperature of 40° to a final temperature of 70°.

Discussion by E. A. Briner.

The brief remarks following are based on sixteen years of experience in ventilation work, of which the last seven years have been devoted almost exclusively to paper mills, covering experience with about seventy paper machines and their machine rooms.

In order to get to his subject quickly, the writer will agree with the engineering principle stated by Mr. Ryan that some form of fan system for air supply and fan system of exhaust afford the most practical system for obtaining results.

An exhaust hood over the paper machine is a most desirable adjunct of the exhaust system, although, as will be shown later, it may not be an actual necessity under certain conditions of the air supply, where air is applied directly to the sheet instead of merely blowing the air against under side of roof.

The point about the hood is simple enough. A hood over a paper machine is sure to get rid of at least 80% vapor troubles at once without contact with cold undersurface of roof in winter. In summer the hood keeps down the machine-room temperature by quickly removing both heat and moisture.

The air supply and exhaust fans must be figured amply sufficient to carry off all the moisture evaporated from the sheet of paper at the temperature that air usually leaves the hood,—around 105° to 110° F. on large machines. Of course it is customary to allow a margin of safety of between 25% and 50% to insure success and permit an increase in production. Mr. Ryan's statement of quantity of water evaporated as being about double the weight of the finished paper is correct for covering quite a broad field of practice in paper such as news, writing paper, book, wrapping, pulp, roofing felt, some grades of boxboard, etc.

Mr. Ryan has touched upon the value of recirculating the air whenever possible; a few practical examples illustrating this will be shown; after all the economy of the system is the final test which all systems have to meet.

Not only can the air be recirculated to a much greater extent than is current practice, but by taking advantage of unavoidable leakage and the principle of continuous ventilation by using air received from other departments, the economy of the ventilating system in machine rooms can be brought to a satisfactory commercial basis without usual heavy expense for fuel.

ECONOMY OF FUEL.

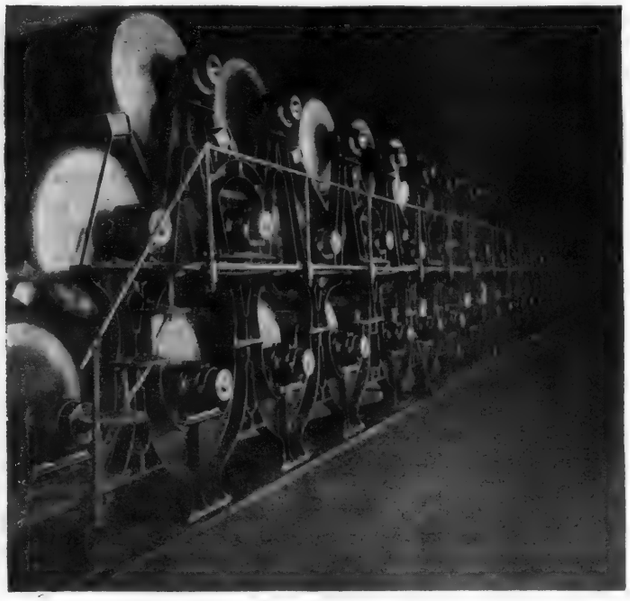
In Canada with abundant water power there is usually very little exhaust steam available from engines around paper machines. If all the exhaust from engines is used in dryers of paper machine, the ventilation ordinarily would become a live steam proposition, which is very expensive in view of the fact that the machine room requires such enormous quantities of air.

A practical illustration of the steam required (in round numbers), shows this weak spot in paper mill ventilation practice. In a machine room in which eighty tons of finished paper or dry pulp is turned out every twenty-four hours the moisture leaving that machine room per twenty-four hours would be 160 tons, or over 6½ tons of water per hour must be carried out of the roof ventilators on the "wings of the air."

Suppose we have to supply this air without going to extremes in zero weather. It would require in round numbers 60,000 cu. ft. of air per minute raised to 90° F. or 200 boiler horse power, if live steam were used, all air being taken from out of doors. By proper recirculation of the air and raising its temperature this can be reduced to about 100 boiler horse power. The re-circulated air is not quite as good as fresh, dry outdoor air, but there is economy in its use.

Proper recirculation of the air sounds well, but it is not understood by the average machine tender or mill superintendent. It must be incorporated in the design.

There is usually a tremendous amount of leakage of cold air into the shipping room. It is, therefore, good practice to try to begin there and arrange to recirculate all of this air in heating and ventilating the shipping room. The writer never makes provision in the shipping room for taking a separate air supply from out of doors and always lets the air come in as it is found to come in around shipping doors, but warm air ducts are arranged to blow warm air on the floor just at the side or from over the tops of these doors. When shipping doors are opened occasionally the incoming air is tempered with this hot air. By providing no separate fresh air supply to the shipping room, it breathes naturally, is warmed artificially around the



TRIPLE-DECKER PAPER MACHINE EQUIPPED WITH VAPOR-ABSORPTION SYSTEM
This machine has 97 dryers, 42-in. diameter by 138-in. face, averaging 100 tons per day

shipping doors and the system cannot be misused by careless handling of fresh air inlets in cold weather. Scarcely any moisture is picked up in the shipping room and invariably there is a current of air continuously going from shipping room to the machine room, to which it is drawn by the exhaust fans.

If no provision is made for recirculating the air by roof drying fans of the machine room, this air coming in from the shipping room would assist in carrying off vapor from drying machine. But by recirculating it in the machine room and blowing it up against the roof first, it serves the purpose of keeping the roof dry at less expense than when the air is taken directly from out of doors, and then serves its final purpose in assisting the drying operation.

What has been said of the shipping room in the way of air supply, applies with almost equal force to beater room or screen room, usually at the other end of machine room. There is always plenty of air leakage in such rooms augmented by open doors through which perhaps stock is brought in. This leakage all finds its way into the machine room on account of suction of roof ventilators or machine hoods.

The methods of "continuous ventilation" described have worked out very well in a number of instances in machine rooms; and at same time have reduced the relative humidity in such rooms from about 80% to about 55%.

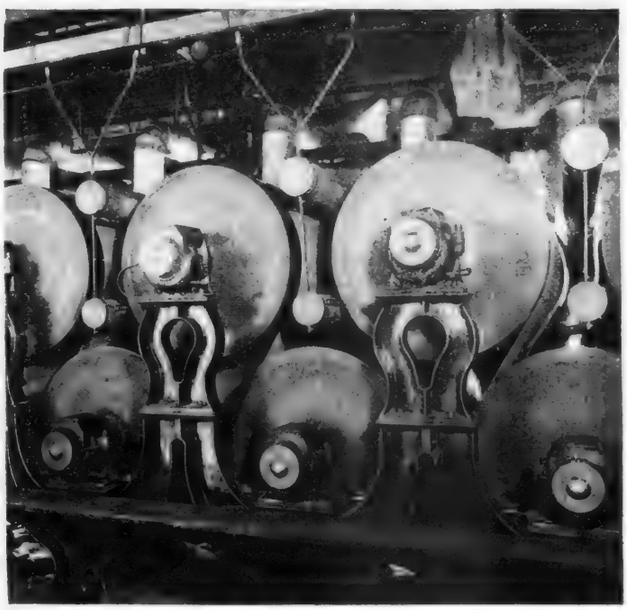
WASTE HEAT.

Lest some might think that considerable progress has been made in paper mill economy and would be inclined to feel satisfied with results achieved the writer will turn a little more light on the subject and point out another weak spot; Mr. Ryan has mentioned it in his paper. It is the heat escaping from hood or exhaust fans over dryers of the paper machine.

Mr. Ryan's figures are given as 464,000 B. T. U. per minute for a machine room making 150 tons of finished paper per twenty-four hours. If these figures are reduced to boiler horse power, for his 150 ton mill 843 boiler horse power is continually going to waste or about 5⅔ boiler horse power per ton of product. To be very conservative 5 boiler horse power per ton of finished product goes to waste "up the flue." In the 60 ton mill example, not less than 400 boiler horse power goes to waste.

A couple of years ago the writer installed a system for a large boxboard manufacturer in the West, making over 100 tons per twenty-four hours on one machine. His mill was a model for fuel economy. It held the record for tonnage on a single machine. It also held the record for coal economy per ton of paper in the United States. The writer was able to show him with figures that not less than 500 boiler horse power was going to waste out of the roof of his paper mill. When he finally acknowledged it, he remarked: "Yes, I see the horse is there all right, but can you harness him up?" That sort of loss has taken place in a thousand and more paper mills in the States and Canada and in spite of all the talk about cost keeping and scientific accounting the writer believes that not a single set of books is in existence that shows this continuous loss.

You may be interested to know that Canadian winters helped to solve this problem. The thought came to look at the machine room problem very much as a breathing problem. Cold dry air is inhaled and warm moist air is expelled. What would happen to a man in Canadian weather twenty degrees below zero if he breathed through



USE OF DEFLECTOR NOZZLES ACROSS ENTIRE WIDTH OF SHEET IN CONTINUOUS STRIP
When Machines have dryer felts, they require a different arrangement.

his mouth and exhaled through the middle of his back? Someone has said that his mouth would freeze up. This teaches the importance of taking air in and exhausting if possible from the same opening.

The new Briner economizers will probably recover more heat than is necessary for ventilation of paper machine rooms and it is possible that their efficiency will run so

high that some heat will often be available for heating shipping rooms and other rooms adjacent to machine room, producing wonderfully dry and delightful atmospheric conditions and using practically nothing but waste heat and the necessary electric power to drive the fan apparatus.

BRINER SYSTEM OF VAPOR ABSORPTION ON PAPER MACHINES.

Briefly the originators of this system were Belcher and Wilson. The connection which the writer has had with the same has been only in reference to recent development and the engineering work of most of these systems in use. The principal object of this system is to supply a series of blasts of hot dry air to the sheet on the drying machine instead of against the cold roof. The effect of this is equivalent to laying the axe at the root of the tree, increasing the drying capacity, and at the same time entirely removing by absorption all visible vapour and eliminating the roof drip. On machines, without dryer felts, it increases the drying capacity approximately 15% if the work is very thoroughly and accurately done. On machines making boxboard it makes a decided improvement in the quality of the product. The product has a smoother, more velvety feel which calenders better because sheet has been dried on both sides simultaneously and the moisture has not been forcibly driven through the sheet, which has a tendency to disturb the "lay" and bond of fibre in the outer layers.

The effect on room conditions is to reduce the relative humidity often from 80% to 50%. If properly installed it keeps down the room temperature a few degrees. The dryer atmosphere, however, has a much more important effect on comfort than a few degrees lower room temperature.

ROOF CONSTRUCTION.

Those who do not have to contend with moisture in buildings seldom realize the amount of work and operating expense which they incur by thoughtless roof construction.

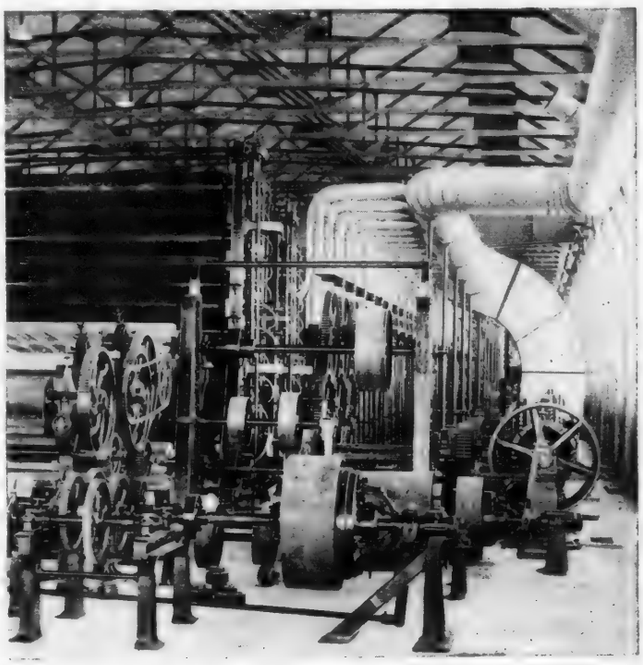
A 4-in concrete slab makes a first class fireproof and waterproof roof; but it has such poor insulating properties that it is exceedingly difficult to keep dry. It can be done

120-IN. PAPER MACHINE FOR MAKING WALL BOARD. EQUIPPED WITH VAPOR-ABSORPTION SYSTEM
Output of 69 tons per day obtained which was extended when more dryers were added

if the first cost of the system and operating expense are ignored. It is much more economical to provide a 4-in. air space on top and 2-in of wood as an insulation with regular roofing material on top. Such roofs were put on all buildings of the Riordon Company at Temiskaming Plant, and in conjunction with ventilating systems installed there they have been a complete success in weather 15° and 20° below zero.

Another construction coming into use is 4-in. reinforced gypsum slab with the regular roofing material on top. The gypsum has only half the weight of concrete and requires no further insulation. It is fireproof and if the ventilating system is first class it is fully equal to the concrete roof even though it is not waterproof.

If the owner cannot afford fireproof construction then the roof should be at least 3-in. thick of wood and prefer-



ARRANGEMENT OF MAIN PIPE AT REAR OF MACHINE SO AS NO TO INTERFERE WITH TRIPLE DECKING OF MACHINE.

ably 4-in thick for Canada,—principally on account of insulation.

If the roof has not the proper insulation, it must be offset by increased cost of ventilating system to keep the roof dry and a continual extra expense for operation.

CONCRETE DUCTS.

The use of concrete in the building of air ducts at Riordon' Company's plant at Temiskaming is a forward step of some importance. Not only the underground ducts in machine room but also the overhead ducts in machine room and other buildings were built of concrete. All the air ducts in this extensive plant are built of concrete. There are no galvanized iron ducts in the plant. The owners had experience in paper mills with the life of galvanized iron and they wanted a construction that would last forty or fifty years without expense for painting or renewals. This is not the first time that such ducts were built. The owners had built some before which were 4-in. thick. The new ducts evolved with their cooperation were a big improvement. They are reinforced concrete and thickness runs from 1-in. in small sizes to 1½-in. in large sizes. The ducts are finished up smooth on the inside. They are reinforced with rods ¼ to ½-in. in diameter and covered with galvanized Clinton wire cloth, which forms the lath for applying cement plaster by hand. The cement plaster consists of one part Portland cement and three parts sand. The only objection to them is their weight.

Allowance is made in the way ducts are hung for expansion and contraction of 1-in. per 100 ft. of length. A year's use of these ducts in one of the severest winters of recent years when temperature at Temiskaming hovered

between 15° and 20° below zero during the whole month of January, they developed no defects in construction and every indication is that the owners have achieved their purpose of permanent construction and low maintenance. The writer has been told that in that severe weather there was no drip in this entire mill, which must mean a great saving in upkeep, renewals and efficiency.

An advantage of the concrete construction in duct work is that it can be done by regular building mechanics such as plasterers. They are built right in place with ordinary materials. It is easy to connect the last part of duct work with the fan after it arrives. On account of the newness of this work, its first cost is naturally greater than sheet metal work; but the writer believes that further experience with this work will bring the first cost down.

Undoubtedly, in a concrete building with its character of permanence, the concrete air duct has found its rightful place. In all the overhead work, the ducts being same color as concrete slabs, beams and columns, they fit into their surroundings beautifully and present a harmonious appearance that melts into the general structure.

INSTRUCTION COURSE FOR CUSTODIANS AND JANITORS

Lesson No. V—Handling Direct Radiation

By EDWIN S. HALLETT

Chief Engineer, St. Louis Board of Education

STEAM and hot water radiators are so simple it would seem needless to give instructions for their care, yet in the course of a month one will see and hear evidence that proves that direction is very much needed. The public in a measure, is to blame for enduring the hammering and churning of radiators in a new job. It is hoped that the non-technical reader of these lines may rise in his wrath at the acceptance of heating apparatus which produces any sounds or smells whatever.

ONE-PIPE GRAVITY SYSTEMS

This is the simplest of all steam heating. The pipes must be much larger than with a two-pipe job, as the steam must flow in and the condensation water out. The most common mistake is in closing the valve part way in an attempt to regulate the heat of the rooms. This can *not* be done. The valve of a one-pipe radiator must always be wide open or tightly closed. If the valve becomes worn and leaks through into the radiator while closed the radiator will gradually fill up with water so that when the valve is opened a terrible pounding and surging will occur for some minutes while the water is working out against the steam pressure. Many radiators produce a churning noise due to the accumulation of some water in the radiator because the radiator and pipe are not graded with sufficient fall toward the riser. The first indication of a radiator filling with water is often a leak in the joints, as water will leak through openings that do not admit steam.

AIR VALVE TROUBLE

Many defective air valves are to be found in use. Steam air valves should be automatic, but not adjustable. Air valves should close against either steam or condensation water. The high-grade modern valve contains a disc filled with a volatile fluid which expands and closes when struck by steam. It also contains a metal float which closes against water. Any adjustable valve will be ruined the first time any adjustment is attempted.

The location of the air valve on a steam radiator is very important. It should be six to ten inches above the bottom tapping of the radiator. In case a hot water radiator is used for steam a new air valve tapping must be made lower down. The reason for this is the fact that air is heavier than steam and when not released properly the radiator will not entirely heat. Air valves often stick fast and must be released or preferably replaced by new ones.

Steam radiators in a series of rooms one above another may not heat up due to a pocket in the run out from the main to the riser. The run out may have had sufficient fall when installed and settlement has dropped the riser down, or the riser may be supported by an anchor several stories up and the down-ward expansion when hot makes a pocket at the bottom. In either event none of the radiators on the riser will heat.

TWO-PIPE RADIATORS.

The vacuum systems of steam heating require other rules. If the radiators do not heat up it may be due to the hand control valve being closed or the valve off the stem. On old systems the small steam pipe may be closed by scale and rust. The vacuum motor valve on the return end of the radiator may be stuck or clogged with scale and core sand. This system admits of regulation by partially closing the hand valve or the use of some modulating valve. The discussion of automatic heat regulation will be the subject of a separate chapter.

A careful inspection of the radiators and lines to detect air leaks is necessary to prevent loss of vacuum. It is often necessary to put a pressure on the vacuum lines to locate the air leaks. Where a vacuum producer is used instead of a vacuum pump, it should be determined whether the lost vacuum is due to the line or the producer. The steam jet vacuum producers operate by alternately admitting steam into a chamber and then condensing with a spray of cold water or an equivalent means. These processes are very delicate and a small deviation from the ideal will stop operations.

Worn valves are a common source of failure. Vacuum pumps, either steam driven or electric are dependent upon correct packing and valves for good service. An effort is made to have hot water flow to the suction of pumps in other practice, but in vacuum systems the pump must pull on the suction and the methods that have been successful on feed pumps fail utterly with vacuum pumps. The rods must be kept smooth and true, without end shoulders. Then the packing must fit perfectly without hammering or squeezing and lay smoothly against all surfaces. This is the place next to ammonia service to test the skill in packing pumps. The highest grade of hot-water pump valves must be used. The busy custodian is tempted to slight this job.

Vacuum air line systems have dry air lines and use some kind of ejector to produce the vacuum. The advantage of

this is the same as other vacuum systems in that the steam pressure is kept down to or below atmosphere and the air is kept out of the radiators. In large plants it affords the best means of handling the condensate. The engineer who maintains a uniform vacuum condition will avoid many disagreeable things.

ODORS FROM RADIATORS.

Radiators which have air valves discharging into the room often produce bad odors which come from the steam lines. Steam plants which operate steam pumps and engines introduce oils and greases into the boiler. Some plants use boiler compounds which are odoriferous. A new plant always contains enough lard oil in the pipe to smell for several years. So that where bad odors are objctionable the air valve discharge must be piped back in ¼ in. pipe with the steam line. The objection to a humidifying device attached to the radiator is the introduction of odors which are more and more objected to. Radiators must be as little in evidence as possible. They occasionally leak in the nipple connections or at the valve packing. If the screw nipple leaks the left and right threaded nipple is unscrewed with a special wrench.

The nipple can be cleaned and coated with Smoothon cement or lithorge and glycerine and make a permanent repair. A sand hole in the cast-iron can be stopped by drilling and plugging. If it is only a sweat it may be stopped by peening with a ball pen hammer. When sections are cracked at the nipple the section must be removed and if a new one can not be obtained, shorten the radiator by this loop. Care is necessary in opening up slip-nipple radiators to keep them from injuring the taper of the holes. Use a pinch bar or wedge in separating the sections after the bolts have been removed. Slip nipples and holes must be cleaned and oiled but do not use any cement or other substance. Pull up square and not too tight. Skillful handling of radiators by the custodian adds to the popularity of the heating system.

MUNICIPAL WELFARE AND GAS HEATING

By DAVID H. CUYLER.

The steady and growing demand for gas fuels for house heating purposes, and for industrial usage, will have a very far-reaching effect on the every-day existence of those who "live and move and have their being," in the cities and towns of the land. We have lately discussed at length the mechanical features and methods for use where gas is to be used as fuel. We have only started in the transition from our present well-defined familiarity with hard-fuel practice, but we may be assured that the present ferment and increasing interest, that is so evident in contemporary engineering literature and discussion, will bring into the realm of fact some truly practical ideas and results. We, at least, feel that there is a decided inclination in this particular direction.

ATTITUDE OF GAS-PRODUCING COMPANIES.

Further, we are obliged to note the fact that the gas-producing companies all over the land are assuming an ever-increasing interest in this subject. They are becoming alert to the fact that it will be likely to be their product that will be required to meet the industrial and domestic fuel situation. Note, for example, the following clause from a recent issue of *The Gas Record*:

> "The evolution of progressive gas slogans has developed something like this—'Place a gas range in your home,'—'The all-gas kitchen,'—'The all-year; all-gas kitchen,'—'and the gas fraternity is now preparing to develop and work to the accomplishment of the slogan, 'The all-year; all-gas home.'"

The heating of buildings by gas is quite in line with evolutionary progress, and thus the practice is sure to be a future realization. We only await the development of the highly efficient gas-fired heating device, and if reports at hand concerning a new heating unit that has lately been placed on the market, are reliable, we are about on the eve of this much-desired accomplishment. The manufacturers of this device are advertising an efficiency of a little better than 96%, and if this proves to be exact, or even approximately so, we can begin to look out upon a future that will be big with promise and interest for all concerned.

THE "ALL-GAS TOWN."

The idea we desire to bring to mind at this time concerns the vast influence that a wide use of gas fuel for industrial and domestic purposes will have on the life and welfare of both our urban and suburban population. It is a most interesting study, and one that touches the interest of every member of the community.

For the purpose we have in mind, let us imagine a small city of perhaps 30,000 population, where all of the homes, business places, etc., are gas-heated, and where all of the industries are gas-operated where heat is required; in fact, a city where no raw coal is used at all. In plain words, let us look out into the future and picture "the all-gas town."

This city will have its efficient and up-to-date gas plant, with its usual distillation and distribution systems, and kindred departments.

Then if we start with the homes, business places, etc., we will note an entire elimination of labor for handling coal and ashes; a total saving of space for coal and ash storage; a complete absence of all ruinous dust and dirt that has been a necessary stigma with the use of coal, and beyond all this, the assurance of properly and evenly-heated homes, where the heat-producing devices are subject to a much finer degree of automatic regulation than can be had with any other type of heating apparatus. These factors will prove to be a very material benefit in increasing the comfort and health o the people who occupy these homes, for it is a known fact that evenly-heated living premises are a great insurance against many of the "ills that flesh is heir to."

THE COAL-HANDLING PROBLEM.

Our next step will take us outside the wall of the buildings, and this phase will concern the delivery of the fuel to the various points where it is to be used. With gas, the fuel is always there, ready for use when required, with no attendant labor beyond the turning of a valve and the lighting of a match. The delivery problem has been met once and for all time with the initial act of installing the meter.

With coal, we should take into account, among other things, the quite considerable area of more or less valuable city

property that is utilized for coal storage and handling; the cost of erecting sheds, trestles and fencing; the cost of trucking and equipment, and of trackage and the handling of cars and their tonnage. These yards are generally well within the town limits, while a gas-producing plant may be placed well outside and on less important land. So here we can picture an almost unending expenditure of money and energy that a more conservative future will not be likely to tolerate.

As to the local dealer who will be eliminated through the growth of gas-fuel usage; the class is not so large or important that we need to be concerned with it at all, and as for his employees, these are mostly clerks and laborers; two classes of labor that are generally in demand in other and more important industries. Thus we find this objection not pertinent to the subject, beyond its interest as an evolutionary transition.

CONSERVATION TO BE THE CONTROLLING FACTOR.

This is a vision maybe, but it will be found to be one that is to grow more and more into fact with each succeeding generation. The importance of what has been stated above is obvious and quite in harmony with the present trend of things. The underlying cause which is father to the effect, that the gas-utility industry is striving to bring to public notice, is deeper and more vital than any of these.

We speak now of the element of conservation which is the warp of the whole matter. This may be classed as vitally important because it very materially concerns the national appeal for the conservation of natural resources, and a more exact knowledge and regulation of the waste of natural energy. We have arrived at that stage of our national existence when we are called upon to surmount this problem in every walk of life. We of the heating industry are mostly concerned with the conservation of the natural fuel resources of the country. We have the coal; we have the oil; what we will need to have in the not far distant future are methods and practices for more conservatively utilizing these resources.

It would not appear to be adequate that our efforts are all towards the producing of more efficient coal-burning apparatus; be these of the smokeless type or otherwise, and it does not argue well for the thought processes of the profession that we allow ourselves to cease here. We are undoubtedly possessed of all required technical data and facts up to the present state of our development, but must we not continue to think in terms of a widening and more desirable development? Facts can be changed and still continue to be facts, and no matter how compelling an erstwhile tradition may seem to be, we have perforce to cease living by tradition once in a while, and become practical dreamers.

NOTHING DISQUIETING IN IDEA OF GAS AS THE UNIVERSAL FUEL.

We need not be at all fearful or panicky in realizing the truth that is back of the statement that many of the gas men are voicing nowadays; that gas will be the future universal fuel for all domestic and minor industrial purposes. It is not outside the realms of possibility to imagine whole communities using gas for these requirements; when coal will go only to the gas and electric plants where it will be utilized with the conservative methods of science and economy back of the process, and where the valuable by-product constituents of this coal will be saved for use in other important industries.

This is the story then of a vision. Yes, we will call it that, if it is pleasing, but in closing it is well to recall that the use of electricity for lighting purposes was, not many years ago, pronounced to be a mere chimerical dream and "now look at the darn thing."

BACK TO FIRST PRINCIPLES

An Elementary Course in Heating and Ventilating Engineering

Lesson No. 2—Heat Transformations, Sources, Manifestations, and Transfer Methods.

BY REID DAVIES.

THE table of mathematical analogies given in Lesson 1 showed that the phenomena of heat, electro-magnetism, and motion are closely interrelated with respect to their mathematical expressions. If space had permitted, possibly the phenomena of light and of chemical activity might also have been shown as included in this related group of force systems. However, that table sufficed to convey the general idea in mind. It now remains to show another relation that is known to exist among these force systems.

ENERY TRANSFORMATIONS.

Between mechanical, electro-magnetic, luminous, chemical, and thermal force phenomena, there is a kinship more vital than that shown by mathematical analogies, which is suggested by the fact that energy transformations from any one of these systems to any other, can be effected in accordance with the law of the conservation of energy. Two facts worth noting in connection with these energy transformations from one force system to another are; first, that there is always some loss in the process, the efficiency of transformation never reaching 100%; and second, that the loss always occurs in the form of heat produced by the transformation process, or incidental to it. Only when the production of heat is the desired object can an energy transformation process be considered as 100% efficient. Since energy can neither be created nor destroyed, it follows that the eventual summation of a cycle of energy transformations will show neither gain nor loss of heat energy. That this theory represents an actual fact has been proved experimentally so often that there is left no room for question regarding its accuracy.

ENERGY EQUIVALENTS.

This means that the energy balance suggested in Lesson 1 as a test for new devices and processes, reduces to its simplest form in the heat balance and that the law of the conservation of energy can be considered as a law of the conservation of heat and stated in the following way: The amount of heat put into any substance, machine, or operation is all that can be taken out of it. In order to figure out a heat balance in practical work, it is necessary to know certain mathematical relations between the energy units of the several force systems. The relation between mechanical, electro-magnetic, and thermal energy units is shown in the following equation:

$$\underset{\text{Mechanical}}{778 \text{ Ft. Lbs.}} = \left\{ \begin{array}{c} \underset{\text{Electro-magnetic}}{1055 \text{ Joules}} \\ \text{or} \\ .293 \text{ Watt Hrs.} \end{array} \right\} = \underset{\text{Thermal}}{1 \text{ B. T. U.}}$$

The chemical equivalent of heat is shown by the number of B. T. U. of heat energy liberated by various kinds of chemical reactions. In each case the amount of heat, or thermal energy, liberated depends upon the character of the reaction. It will suffice to give at this point a single illustration: The complete combustion of 1 lb. pure carbon to carbon dioxide CO_2, yields or releases 14,600 B. T. U. of thermal energy, and the energy

yield is independent of the rate at which combustion occurs.

ENERGY TRANSFORMATION PROCESSES.

Energy transformations in both directions between the thermal and each of the other force systems, can be effected by direct methods. Mechanical energy, or work, is transformed into thermal energy, or heat, by friction which is mathematically expressed by the ratio of a force divided by a velocity. The meaning of this ratio is that, if the friction value is high, the velocity will be low under the action of a force of constant value, and vice versa. The emery wheel furnishes a familiar example of the transformation of mechanical into thermal energy by friction. Thermal energy is transformed into mechanical energy by the expansion of substances exposed to the action of heat. The operation of the steam engine depends upon this effect.

Electrical energy is transformed into thermal energy by resistance which is mathematically expressed by the ratio of a force divided by a current. Familiar examples of this effect are the various forms of electric heating and cooking devices, in all of which the essential feature is a heating element consisting of resistance wire. Thermal energy is transformed into electrical energy by the action of heat upon the contact joint between two dissimilar substances (usually metals, and most familiarly the metals antimony and bismuth). The nature of this effect is not thoroughly understood, but the fact of its occurrence is utilized in the construction of the pyrometer. used for measuring temperatures above the practical range of the ordinary thermometer.

Luminous energy, or light, is transformed into thermal energy through the absorption of light rays by dark surfaces. A practical application of this effect is found in the bolometer invented by Professor Langley for measuring the heat produced by the absorption of light. With this instrument he was able to measure the amount of heat that reaches the earth by reflection from the moon's surface. Thermal energy is transformed into luminous energy by the heating of substances to a point where they emit light. The incandescent lamp is a familiar example of this effect. Electro-magnetic energy is transformed by the resistance of the lamp filament, into heat. This heat raises the filament to a temperature where it becomes incandescent, that is, where it transforms part of its thermal energy into light.

There are several kinds of chemical reactions which serve to transform chemical energy into thermal energy. In general these are called exothermic changes, and among this class of reactions the most important, from the standpoint of the heating engineer, is the kind of chemical reaction known as combustion, which is illustrated by the burning of any kind of fuel and which we will consider more at length, presently. That class of chemical reaction in which thermal energy is transformed into chemical energy, is called endothermic change. A certain amount of heat is required to separate the molecule of any chemical element into its constituent atoms, so this process is always an endothermic change. One such change, of particular interest to the heating and ventilating engineer, is the process of converting atmospheric oxygen from its natural to its nascent form, known as ozone. The latter is a much more active oxidizing agent than is oxygen in its more usual form, and is utilized to purify used air so that it can be re-circulated without being re-heated, and at the same time without injury to those who breathe it. The subject of ozonation will be more fully treated in a future lesson. The point of immediate interest is that ozonation of atmospheric oxygen requires the expenditure of a certain amount of heat energy which is developed by the discharge between electrodes maintained at a high potential difference, or voltage.

HEAT SOURCES.

Coming back to the subject of combustion, which is the principal source of heat at present available for practical use, let us consider the character of the process itself and the method of computing amounts of thermal energy released by it. The form of combustion of most practical interest to the heating engineer, is that involving the combination of certain other chemical elements with the element oxygen. By custom oxygen is called the supporter of combustion, while the others are called combustibles. These combustible elements are contained in various substances which are grouped under the general term, Fuels. Most of the oxygen for the combustion process is obtained from the air, although there is often a small amount of oxygen present in the fuel itself.

COMPOSITION OF AIR.

At this point it may be of interest to record the composition of atmospheric air which is a mechanical mixture (not a chemical compound) of the substances indicated in the following table:

COMPOSITION OF ATMOSPHERIC AIR BY VOLUMES.

Nitrogen	769.6500 cu. ft.
Oxygen	206.5940 cu. ft.
Water vapor	14.0000 cu. ft.
Argon group	9.3700 cu. ft.
Carbon dioxide	0.3360 cu. ft.
Hydrogen	0.0400 cu. ft.
Ammonia	0.0080 cu. ft.
Ozone	0.0015 cu. ft.
Nitric acid	0.0005 cu. ft.
Atmospheric air	1000.0000 cu. ft.

This table represents the average volume composition of normal atmospheric air. The item of percent water vapor content, or relative humidity, is subject to considerable variation depending largely upon the temperature of the air.

From this table of volumes it is apparent that the last four items are comparatively insignificant. From the combustion standpoint the elements of the argon group together with carbon dioxide, being chemically inert and at the same time relatively small in volume, can be conveniently included with nitrogen which is similarly inert in the combustion process. Because the water vapor content of atmospheric air is so variable and because it has no chemical effect in the combustion process, it is convenient to disregard this item also. Then the average composition of normal atmospheric air by weight can be considered, for all practical purposes as,

Nitrogen	76.6%
Oxygen	23.4%
Air	100.0%

or, since we are primarily interested for combustion computations, in the weight of oxygen in pounds and of air in pounds, and in the relations of these actual weights to corresponding volumes, the two tables can be combined for convenience into the following single table:

EQUIVALENT COMPOSITION OF ATMOSPHERIC AIR BY WEIGHTS AND BY VOLUMES, AT 32° F., 14.7 LB. PER SQ. IN.

Nitrogen	3.27 lbs.	41.65 cu. ft.
Oxygen	1.00 lb.	11.20 cu. ft.
Air	4.27 lbs.	52.85 cu. ft.

PRINCIPAL COMBUSTIBLE ELEMENTS.

While the number of different fuels is considerable, the number of combustible elements in them is limited for practical purposes to carbon, hydrogen, and sulphur. Carbon monoxide

TABLE 1—COMBUSTION DATA ON PRINCIPAL COMBUSTIBLES

1 lb. Combustible	Atomic weight	Molecular symbol	Molecular weight	Lbs. Oxygen Req'd.	Combustion product	Molecular symbol	B. T. U. released	Temperature rise—Deg.F. Const. Pres.
Carbon	12	C_2	24	1.33 2.67	Carbon monoxide Carbon dioxide	C O C O_2	4,500 14,600	2940 5080
Hydrogen	1	H_2	2	8.00	Water	H_2O	52,000	5010
Sulphur	32	S_2	64	1.00	Sulphur dioxide	S O_2	4,000	3620
Carbon monoxide		C O	28	0.571	Carbon dioxide	C O_2	4,300	5580
Oxygen	16	O_2	32					

From "Elements of Heat-Power Engineering."—Wiley & Sons, New York.

is a combustible gas produced by the incomplete oxidation of carbon. Each of these combustibles has its own special requirement of oxygen for complete combustion, as shown in the following combustion table:

In Table 1 the molecular weights represent the sum of atomic weights in the molecule, as indicated by the molecular symbol. The weight of oxygen required, is found by dividing the weight of oxygen in the molecule of combustion product by the weight of the combustible therein. The number of B. T. U. of thermal energy released by each of these combustion processes, is determined experimentally by means of the calorimeter. The figures given for temperature rise are theoretical, based upon the assumptions that the pressure is maintained constant, that the exact theoretical oxygen requirement is supplied, and that no heat energy is dissipated during the combustion process. Of course, none of these conditions is practically possible, but they can be approximated, giving temperature rises somewhat less than these figures. As a matter of fact it is always necessary, if complete combustion is desired, to supply an excess of oxygen over the theoretical requirement. Also it is impossible to imagine a combustion process unaccompanied by some dissipation of heat.

From the above table it is evident that of the three principal combustible elements, the complete combustion of hydrogen releases from 3½ to 4 times as much thermal energy as is released by the complete combustion of carbon, and about 13 times as much as is released by the complete combustion of sulphur. In practical work the presence of sulphur in a fuel is not generally considered as an unmixed blessing, since the combustion product, sulphur dioxide, is readily soluble in water and is in the habit of combining with water vapor in the flue gases from furnaces and boilers, to form sulphurous acid, according to the equation,

$$SO_2 \text{ plus } H_2O \text{ gives } H_2SO_3.$$

The principal function of this acid is to eat away the iron work of the chimney, so that every few years a new top has to be installed on the chimney. It has much the same effect on human lungs, with the exception that it is not usually possible to install new lungs.

ORDINARY FUELS.

Heating values ordinarily assumed from tests of the various kinds of fuel usually available, are shown in Table 2. These are merely approximate values, for in practice heating values are found to vary considerably with the grade of fuel obtainable.

HEAT MANIFESTATIONS.

In the preceding paragraphs have been shown the principal sources of thermal energy. The next point of interest, from the engineering angle, is the way in which energy in that form affects material substances. Heat manifests its presence in three ways, that is, the application of heat to any substance serves to change the substance in one or more of these ways (usually to some extent in all three ways simultaneously):

1 Raises the temperature of the substance,
2 Changes the molecular structure of the substance,
3 Increases the volume of the substance.

INTERNAL LATENT HEAT.

Heat energy which produces rise in temperature is called sensible heat and needs no explanation. That part of the applied heat which serves to produce changes in molecular structure, is not apparent to the sense of touch but is quite apparent, at times, to the sense of sight. It is largely the effect of internal latent heat which changes ice of temperature 32° F. to water at the same temperature, and which changes water of temperature 212° F. to steam at the same temperature (part

TABLE 2—HEATING VALUES OF ORDINARY FUELS.

Fuels	Range of Heating Values
Solid Fuels	
Coal	
Anthracite	14,900—15,300 B. T. U. per lb.
Semi-anthracite	15,300—15,800 B. T. U. per lb.
Semi-bituminous	15,600—15,800 B. T. U. per lb.
Bituminous, Eastern	14,800—15,800 B. T. U. per lb.
Bituminous, Western	13,700—15,200 B. T. U. per lb.
Peat-dried	12,000 B. T. U. per lb.
Coke	14,600 B. T. U. per lb.
Wood	12,750 B. T. U. per lb.
Charcoal	14,000 B. T. U. per lb.
Liquid Fuels	
Crude oil	18,000—22,000 B. T. U. per lb.
Gasoline	19,200 B. T. U. per lb.
Kerosene	18,500 B. T. U. per lb.
Fuel oil	18,000 B. T. U. per lb.
Alcohol	10,500—12,000 B. T. U. per lb.
Gaseous Fuels	
Natural gas	950—1000 B. T. U. per cu. ft.
Coal gas	900 B. T. U. per cu. ft.

From "Elements of Heat-Power Engineering," by Smith, Hirshfeld Barnard-Wiley.

of this latter effect may be due to the action of external latent heat, as explained below). These two forms of internal latent heat are known as the Latent Heat of Fusion and the Latent Heat of Vaporization, respectively. All substances display internal latent heat phenomena similar to those mentioned above in connection with water. Also there are probably other internal latent heat manifestations besides the two marked phenomena above described. Radio-activity may be one of these other manifestations of internal latent heat.

EXTERNAL LATENT HEAT.

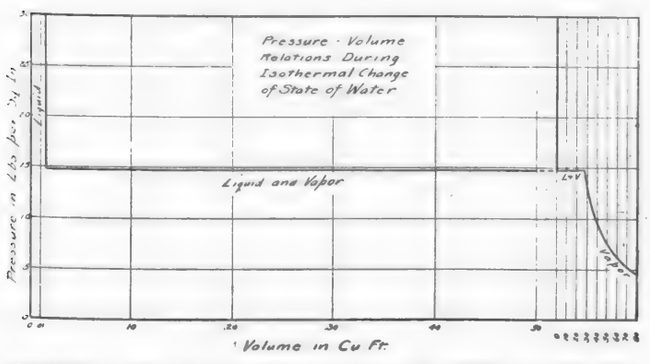
That portion of the applied thermal energy which serves to produce increase in volume of the substance heated, is called external latent heat. Like the internal variety it is not apparent to the sense of touch, but is quite apparent to the sense of sight. It is external latent heat which produces the increase in volume of gas as the pressure is decreased in the course of an isothermal change (meaning a change during which the temperature of the gas remains constant). It is this external latent heat which causes a bar of metal to increase in both length and area of cross-section, when it is subjected to the action of heat.

EFFECTS OF CIRCUIT PROPERTIES

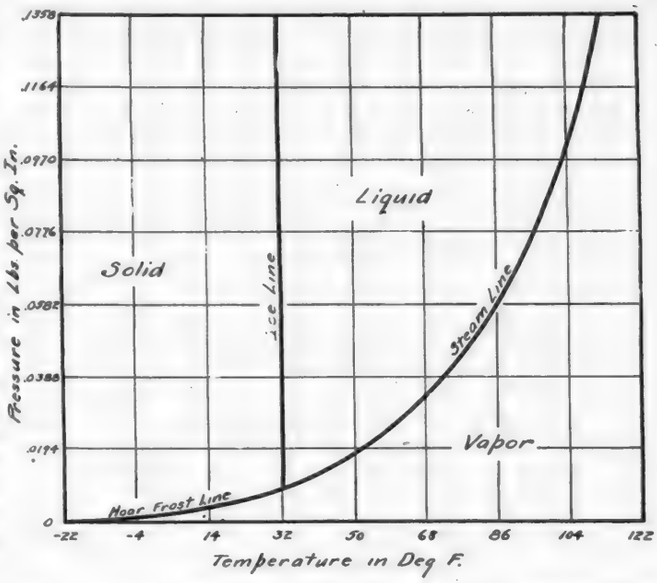
These three forms of heat manifestations are dependent upon the properties of the thermal circuit, as shown in the table of mathematical analogies in Lesson 1. Rise in temperature produced by sensible heat, is controlled by the thermal conductivity of the circuit—that is, practically, of the substance exposed to heat action, since closed thermal circuits are not usual. When the thermal conductivity of this substance is high, the sensible heat is high also. It is of interest to note that, in general, substances of high electrical conductivity possess high thermal conductivity as well, while those of low electrical conductivity have a correspondingly low thermal conductivity.

Change in the molecular structure of a substance effected by the application of internal latent heat, is dependent upon the absorptivity of the substance heated. For instance, the heat energy required to change a given weight of ice to water at the same temperature (32° F.) is about 28 times the amount of heat required to change an equal weight of solid mercury to liquid mercury at the same temperature (—38° F.). The phenomena of change of state from solid to liquid to gas—common to all substances—are directly related to their absorptive qualities and, aside from the phenomena of radio-activity, are the most apparent changes produced by the action of internal latent heat.

Some leading scientists of the present day hold the theory that there are locked up in the atoms of material elements, stores of energy almost unbelievably large, but as yet the method for releasing these possible energy stores remains unknown. Study of radio-activity has led to the belief that it is significant of the existence of such atomic energy stores, but there has not yet been found a means for utilizing the energy



PRESSURE-VOLUME VARIATIONS IN ISO-THERMAL CHANGE OF STATE OF WATER



PRESSURE-TEMPERATURE VARIATIONS IN CHANGE OF STATE OF WATER

discharge from radio-active substances for heating or power service.

The change in volume of a substance, effected by the application of external latent heat, is dependent upon the expansibility of the substance heated. This is illustrated by the fact that the heating of a bar of copper will produce an expansion almost 40% greater than the expansion of a bar of iron of the same dimensions, heated under the same conditions.

The phenomena of change of state are so closely related to the subject of thermal energy that the following diagrams will be of interest as showing the temperature, pressure, and volume variations accompanying these changes of state. In these diagrams water is the substance illustrated, but similar diagrams could be produced for any other substance.

This completes the second lesson and leads up to the subject of Lesson 3 which will deal with human heat requirements and heating systems for populated interiors.

Reference Books.

Elements of Heat-Power Engineering, by Smith, Hirshfeld, and Barnard—Wiley.

Heat for Advanced Students, by Edser—Macmillan.

A Text-Book of Physics, by Watson—Longmans.

Heating and Ventilation, by Allen and Walker—McGraw-Hill.

Heating and Ventilation, by Harding and Willard--Wilev.

Questions.

1. Name the five force systems?
2. What do energy transformations show?
3. Give the mechanical, electro-magnetic, and chemical equivalents of 1 B. T. U. of thermal energy?
4. Describe some energy transformation process?
5. What is the principal source of heat for practical purposes?
6. What form of combustion is of most interest to the engineer?
7. What is the approximate composition of air by weight?
8. Name the principal combustible elements?
9. Name some of the fuels ordinarily used?
10. In what ways does heat make its presence evident?
11. What effect is produced by internal latent heat?
12. What is the effect of external latent heat?
13. Explain the relation between thermal circuit properties and heat manifestations?

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SUPPORTERS of the heating engineers' Research Laboratory in Pittsburgh now have something concrete and practical to reward them for their patience, in the construction of the experimental room for conducting heat transmission tests, shown on another page of this issue. Not only has the experience of the past been drawn on to the fullest extent in planning this room, but care has been taken to adapt it to both heat transmission and air infiltration tests under a variety of conditions and using practically every kind of building material. It is to be noted that the heat transmission tests are to be made both through a wide range of temperatures and also with varying humidities, something, we believe, which has never before been attempted.

No item in the entire heating field is more vitally interesting to all concerned than reliable heat loss factors for modern building construction and if the Research Laboratory should do nothing more than establish the correct coefficients for all the materials in common use, as well as combinations of such materials, it would go far towards justifying its existence. As a matter of fact, however, the experiments will go even further, taking in, for instance, the effect of varying wind velocities. There is thus every reason to hope that in the comparatively near future the industry will have the satisfaction of knowing, at last, what are the correct factors to use in a given problem, instead of relying upon those whose chief claim for merit is that they represent the "consensus of opinion."

STRIKING evidence of the progress of compulsory ventilation in the United States will be seen in the fourth revised edition of "Ventilation Laws," which we now have in press. Starting with a small circular which was large enough to contain all the statutes in effect when the first edition was published in 1906, the laws have multiplied until they now require a volume of standard book size, with a hundred or more additional reading pages.

Probably the most notable development has been the enactment of municipal ordinances, in some cases supplementing the State laws, but occasionally where there are no State laws. There are also now in effect a large number of smoke abatement ordinances in the larger cities and these will no doubt have a very important effect where soft coal is used.

Both Cleveland and Chicago, which have been leaders in the enactment of local ventilation ordinances, report more or less extensive revisions of their requirements. In New York, the State Industrial Commission reports considerable revision to be necessary, in connection with industrial ventilation requirements, several bills on the subject having been enacted at the closing session of the last Legislature which had not, at the time of writing, been acted upon by Governor Miller.

The new edition of "Ventilation Laws" will be ready the latter part of June.

JUNE will be the convention month this year for the heating trade and it is gratifying to see that the clashes of last year in the way of convention dates have been avoided. In the case of two of the conventions, that of the heating engineers in Cleveland, June 14-17, and that of the central station heating men at Cedar Point, the following week, an opportunity is provided to arrange an outing which will take in both meetings. In selecting Boston for their convention City, May 31-June 2, the heating contractors are repeating their visit of a dozen years ago when they held their largest convention, up to that time, at the Hub.

LEAVE it to the West to "put over" new ideas. And by West we mean West. A drive is planned in an Illinois city for the sale of stock in a municipally-owned central heating and lighting company. At the head of the sales organization we find a "switchboard" of fourteen persons who are organized to supply the "current" to the remainder of the machinery. Next we find seven "generators" who are at the head of the organization campaigns in each of the seven districts of the city. Next come a number of "transformers" to manage the various city precincts. Each "transformer," in turn, is "hooked onto" (we quote verbatim) enough "live wires" to carry the campaign or "contact" to every home in the city. Nor is this all. In preparation for any emergency is a company of "fuse plugs," to fill in wherever it is necessary to make a connection.

The next time the heating trade prepares to "start something" we commend the Illinois plan, with suitable modifications, to its attention.

CHATS WITH UNCLE BEN

Some Experiences on Heat Insulation.

Uncle Ben was loafing away the afternoon with me while waiting for the opening of bids at the City Hall, in the evening. The figures were all made up and the bids were filed, and in the reaction the old fellow proposed a walk in the country. We had dropped down on the grass beside an orchard and as we munched some wind-fall snow-apples, he delivered his lecture.

"Here is this lovely fruit, fragrant and tasty, made so by Nature's wonderful processes to tempt some animal to eat it. Did you know that while it is good food, and when ripe, liked and easily digested by all, the seeds, down inside will resist the digestive processes? They have a coating especially resistant to the gastric juices, so that they will be carried intact, far away, there to grow and flourish. But, if by chance this attractive fruit fails to be noticed and eaten, then the advent of cold weather brings a change. The fragrance and the color depart; the juices dry up to some extent, and the skin withers, and the fruit becomes a wonderful insulator for the seeds down inside, keeping the germ unharmed through the severities of winter. Then, in the spring this same formerly beautiful and sweet fruit, after having become a wonderful insulator, is a superbly compounded fertilizer, prepared to start the germ on its cycle. I always did like to contemplate this metamorphosis as an example of the adaptability of that glorified rose, the apple.

Did you know that apple trees are members of the rose family?"

"But speaking of insulation, that makes me want to tell you about my friend Julian and his house. He always did sort of depend on me for help in his heating, and I always said that heating begins in the building of the house rather than in the installation of the boiler. Well, Julian built himself a new, flossy house up on the north shore, and we combined forces in designing it. We had just a common, easy-working gravity, hot water system with an automatic temperature controller, with one big indirect in the front hall to provide fresh air for ventilation and so that he could run his fire places. We knew how you can blow out a candle through an ordinary brick wall, so we coated the inside and outside of the brickwork with a bituminous compound rendering it nearly airtight. We furred the outside walls, taking pains to put anticirculation stops at every floor so as to get dead air pockets and discourage unauthorized fire. When they set the window frames, we saw that they were caulked on the outside and that they were sealed to the walls on the inside with building paper tarred to the walls so as to form flexible air-tight joints all around. These would give and take as the frames swelled and shrank. We put building paper between the double floors, with doped flexible joints, sealing the paper to the walls, again providing air-tightness while allowing for the inevitable shrinkage. We made the top floor ceiling warm with paper below the attic floor, taking care to bind the paper joints on top of rafters, and to dope the paper against the walls. We weatherstripped the windows with honest-to-goodness metal strips."

"Do you know the answer? By the beard of the prophet, Julian heats his house on just one-half the coal it takes for his next door neighbor with the same size house, and in the summer he has to open the windows in order to get warm. Yes, he actually does. What fools we are to put in more radiation and bigger pipes to burn more coal to make more heat to try to heat all outdoors! Did Nature give the polar bear a bigger heart and arteries? No, by cricky, it gave him a fur coat to keep the heat in. Think it over, my boy."

"And I'll tell you something else, in a whisper, just between us—Julian says his wife told him in confidence that in that house they haven't ever had a mouse or a cockroach, or a bedbug, and maybe not a cootie. The insulation we used is not suited to the temperament of these beasts. It seems to give them neuritis or wanderlust, or stomach complaint, or something, for they never stick 'round. No, the stuff doesn't smell. It is the same sort of material they line refrigerator cars with—two thicknesses of paper with Moses-havens or bulrushes in between. Anyhow, it's on the market and is some kind of grass, fireproofed."

"Time for supper; let's go."

LEGAL DECISIONS

Heating Plant in Basement—Damages for Injury by Bursting Water Pipes.

In Rainier Heat & Power Co. v. City of Seattle, 193 Pac. 233, the Washington Supreme Court holds that the maintenance of a heat and power plant at the level of approximately 30 ft. below the street grades is not contributory negligence barring the heat and power company from recovering damages on the bursting of a water main, the company not being required to anticipate danger from such a source, although it would no doubt be obliged to anticipate damage from the natural flow of water and the accumulation of surface water. The owner of land lying level with the street is clearly within his legal rights in excavating a basement 30 feet deep and placing in the bottom of it a heat and power plant, so long as he does not disturb the lateral support which the city is entitled to in maintaining its street at the established grade.

Contract As to Heating Not Excepted from Effect of Utilities Act

A company maintaining an office building, by contract with a public utility company refrained from equipping its office building with the necessary heating and lighting apparatus and gave to the utility company the exclusive right of service to its tenants and occupants of the building. In declaring to be valid contracts which would other wise be discriminatory under the Illinois Public Utilities Act, both the state supreme court and the Legislature have apparently limited such validity to those contracts only, in which there has been a transfer of real estate or property. In the case in question, since the contract conveyed no real or property rights to the utility company, the Illinois Commission, in a proceeding in which the validity of the contract was raised, held that the contract was not within the class of contracts protected by the decision of Schiller Piano Co. v. Illinois Utilities Co., 288 Ill. 586, and therefore is not one beyond the power of the Public Utilities Commission to change.

Warming Buildings with Refrigerating Equipment.

The apparent anomaly implied by this title disappears entirely after a careful study of an article in the April 19 issue of "Power," by Professor Robertson Matthews, Department of Power Engineering, Cornell University. It represents an idea that is new and at the same time en-

tirely practicable and well worth consideration and application to general heating problems—an idea laden with promise as a fuel conservation method.

Professor Matthews bases his whole discussion upon the essential difference between thermal energy of high temperature "head" and that of low temperature "head." In order to get his argument it is necessary to understand that the quantity "degrees F. temperature change" in the thermal force system, corresponds to the quantity "height" in the mechanical force system. The argument opens with the hydraulic analogy (to the general heating problem) of an installation designed to use the potential energy of a small volume of water in a pond at high head to operate a turbine-pump for raising a much larger volume of water from a lake, through a relatively low head, for irrigation purposes. The analogy is striking and its value is in no way reduced by the fact that the hydraulic conditions assumed are of rare occurrence. The heat conditions which they so exactly parallel are precisely those encountered in every heating problem.

In heating work we are faced with the need for raising the thermal "head" of considerable volumes of air through relatively small ranges of temperature and in order to accomplish this we have available potential energy of considerably higher thermal "head," stored in the form of fuel. What we generally do is to "irrigate" our interiors with heat from the fuel "pond" direct, ignoring entirely the atmospheric "lake" of low head thermal energy from which we might secure a large part of our "irrigation" heat.

Considerably condensed, the suggestion of Professor Matthews is that we use an engine-compressor set (corresponding in function to the turbine-pump outfit, mentioned in the hydraulic analogy) to utilize the high head heat of the fuel and the low head heat of the atmosphere together for our interior heating requirements. The steps in this process are roughly, as follows: Thermal energy in the fuel is transformed in the boiler-engine, or in the internal combustion motor, into mechanical energy which operates the compressor upon a gaseous medium (commonly ammonia). Compression of the gas raises its temperature and this heated medium is utilized by means of pipe coils, to heat the air. The rise in temperature of the air is accompanied by a corresponding fall in temperature of the medium, and as this is cooled it changes to the liquid state, and is collected in a receiver. Its pressure is still high. From the receiver the medium passes through an expansion valve and as it expands its temperature falls to considerably below the temperature of the atmosphere. This very cold medium (again a gas, due to the expansion) is run through a second set of pipe coils situated in the path of the exhaust air from the interior. By this arrangement the cooling coils serve to create a down-draft, or suction, in the exhaust flue and at the same time the low head heat in this stream of exhaust air is used to supply a large measure of the thermal energy addition necessary to complete the cycle and bring the gaseous medium back to the compressor where we started, and ready to start again on the same cycle.

Since it frequently happens that there is a refrigeration problem concurrent with the heating problem, it would seem as if the installation above outlined could easily be adapted to serve both requirements, simultaneously and more efficiently than either has yet been served. Of course proper apparatus would have to supplement the right idea in order to get real results. It would be interesting to see such an installation in several lights, the economic and practical aspects as well as the engineering and theoretical viewpoints that were so well presented in the article to which reference is made.

CORRESPONDENCE

Relative Efficiency of Different Forms of Heating Coils.

EDITOR HEATING AND VENTILATING MAGAZINE:

Will you kindly advise the undersigned as to the relative efficiency of two steel pipe coils, one constructed of return bends and the other with two manifolds? These two heating coils are to be of the same square feet heating surface and to operate at the same steam pressure. The condensate will pass through a steam trap and discharge to atmosphere. The coils are to be immersed in an open vessel and to evaporate water against atmospheric pressure. It has been argued that the series coil or that constructed with return bends is more efficient than the manifold.

Will you kindly advise the reason for a high evaporation, using high-pressure steam in a coil when the total heat of low-pressure steam is only slightly reduced from that of high-pressure and trap on end of line prevents high velocity of steam circulating through system.

Ridely Park, Pa. R. S. F.

Consider two 2-in. pipe coils, return bend and manifold types, each made up in four lengths totaling 48 lin. ft. of pipe or 30 sq. ft. of radiating surface. Assume coils transmitting 300 B. T. U. per degree of temperature difference per square foot of radiating surface per hour when supplied with steam at 125 lbs. pressure (353° temp.) and immersed in water having an average temperature of 100°, that is, raised from 50° to 150°. The temperature difference will then be (353 — 100 =) 253° and the total transmission in B. T. U. per hour from each pipe coil will be (30 × 253 × 300 =) 2,277,000; which divided by 60 and the latent heat of 867.7, gives a quotient of 43.74 in pounds of steam condensed per minute. Since in the series coil, there is a total of 48 lin. ft. of pipe and three return bends each offering a resistance to steam flow equivalent to approximately fifty pipe diameters or [(3 × 50 × 2) ÷ 12 =] 25 ft., there will be a total resistance which the steam must overcome of (48 + 25 =) 73 lin. ft. of pipe, whereas in the manifold coil the piping is divided into four paths and there is only one ell to a path. This makes the total resistance, 17 lin. ft. per pipe or path, since one ell has a resistance equivalent to [(30 diameters × 2) ÷ 12 =] 5 ft., and this plus $\frac{48}{4}$ = 17 lin. ft.

In the Babcock formula for flow of steam through pipes,

W = the weight of steam passing in pounds per minute,
p = the difference in pressure between the two ends of the pipe in pounds per square inch,
D = mean density of the steam at the initial and final pressure, or weight per cubic foot,
d_1 = internal diameter of the pipe in inches,
l = length of pipe in feet, then,

$$p = 0.000131 \left(1 + \frac{3.6}{d_1}\right) \frac{W^2 l}{D d_1^5} \text{ or}$$

$$p = 0.000131 \left(1 + \frac{3.6}{2.067}\right) \frac{43.74^2 \times 73}{0.3065 \times 2.067^5} = 4.33 \text{ lbs. drop}$$

This drop in pressure is quite pronounced since high-pressure steam is used in the example; furthermore the coils are immersed in water in which case they condense one hundred times as much steam as when surrounded by comparatively still air.

For the return-bend coil the final pressure is 125 — 4.33 =

120.67, whereas the drop in pressure for a manifold coil is only 0.063 lb., since

$$p = 0.000131\left(1 + \frac{36}{2.067}\right)\frac{\left[\left(\frac{43.74}{4}\right)^2 \times 4\right] \times 4}{0.31 \times 2.067^5} = 0.063 \text{ lbs. drop}$$

This result may be checked by a shorter method instead of by formula, since the drop in pressure (which is 4.33 lbs. for the return-bend coil) increases as the square of the velocity and in the case of the manifold type, steam is distributed through four pipes, hence the velocity is decreased four times and the drop in pressure sixteen times, while the friction distance travelled is only 17/73 or 0.23 times that of the return-bend coil.

Therefore, $\frac{4.33 \times 23}{4^3} = 0.063$ lb. drop in pressure.

Since the correspondent mentions "series coils" rather than the familiar term "return-bend coils," he is evidently familiar with electrical problems and understands that the flow of electricity along a wire is very much like flow of water or steam through a pipe. This analogy to the flow of water is helpful in explaining the flow of steam in the two types of pipe coils. Thus, when pieces are connected in tandem they are said to be in series but when connected so that the current is divided between them they are said to be in parallel (multiple or shunt) with one another. In the series circuit, the same current flows through each part of the circuit and the combined resistance of parts in series equals the sum of the separate resistances, whereas in the parallel circuit the current equals the sum of the current in the separate parts and the total resistance equals the reciprocal of the sum of the conductances of the separate parts.

The conductance is the reciprocal of the resistance; that is, $\text{Conductance} = \frac{1}{\text{Resistance}}$. Thus, if the resistance may be said to represent the difficulty with which an electric current is forced through a wire, the conductance may be said to represent the ease with which the current may be forced through a wire. Since two resistances in parallel offer less resistance than one alone, the conductance of the combination is greater than the conductance of one alone. In fact, conductance of pieces in parallel equal the sum of the separate conductances.

Thus, in the last equation, the pressure drop, weight of steam and the friction (represented by the lineal feet of pipe), correspond to the drop in potential, current and resistance, respectively, of an electrical circuit in a parallel combination. Since the resistance is 17 for each pipe, the conductance is 1/17 and the sum of the separate conductances is 4/17 or the total resistance of the combination is 17/4 as used in the equation.

It will also be seen that while the total weight of steam is the same for each coil, the pressure drop varies as the distance and the square of the velocity, also that the total resistance (17/4) of the manifold coil is less than the resistance (17) of any one pipe in the coil. Thus, for the assumed conditions, the return-bend coil gives about sixty-nine times as much drop in pressure as the manifold type. Of course, the actual drop in pressure would not be as figured, since steam condensed at decreasing velocity in a coil having a trap on its end, is not the same as steam being delivered through a pipe to the coil. Only a proportionate amount is condensed in each foot of the radiating surface, but the same conditions exist in each coil so that the figures are correct in so far as they are used for comparison of one coil with the other.

The heat developed by the flow of steam, a thing which is more noticeable by rise of temperature at the end of long forced water heating mains, and taken into account by Meier in "Mechanics of Heating and Ventilating," is the thermal equivalent of the mechanical power imparted to the water and converted, as resistances are overcome along the pipe line.

The heat necessary to do this work, and given up to the radiating surfaces of the return-bend coil, is obtained from the steam, thus causing a drop in pressure of the steam and a lower temperature corresponding to the lower pressure. The pressure being reduced, the steam is expanded without performing any net work and hence the steam is superheated. The degree of superheat can be estimated by taking the difference between the total heat of steam at the two pressures and figuring how much this will raise the temperature of steam at the lower pressure. In the example this would give an increase in the average steam temperature of about 0.4° and in the heat of the liquid about 0.1°. If these amounts were of any moment, it could be shown that the heat transmission from the return-bend coil would be increased because of the higher steam temperature and that the return losses from radiation in transit would be greater, since the condensation as discharged is at a slightly higher temperature. However, the heat developed by the flow is more apt to re-evaporate condensation than to superheat the steam. Furthermore, the thermal conductivity of superheated steam, that is, its power to give up heat to surrounding bodies, is much lower than that of saturated steam and its heat, therefore, will not be transmitted so rapidly to the walls of the pipe as when saturated steam is flowing through the pipe.

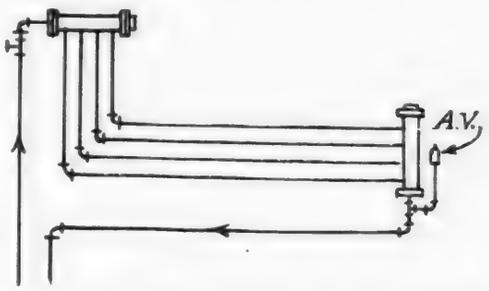


FIG. 1—PROPER CONNECTIONS AT PIPE COIL FOR EQUAL DISTRIBUTION AND LENGTH OF STEAM TRAVEL

In the return-bend coil there is a long travel which the ever increasing quantity of condensation must negotiate before getting out of the coil but this is of no particular disadvantage if drained out at the same rate as the steam flow. For instance, the return ends of the manifold and return-bend coils receive, respectively, twelve and forty-eight times as much condensation as the supply end, but the steam flow in the latter is four times as fast as in the former, so that in either case, the amount of condensate present at any one time is the same.

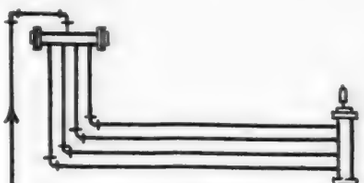


FIG. 2—CONNECTIONS AT PIPE COIL WHICH MAY CAUSE AIR BINDING

So far as the matter can be determined theoretically it does not appear, then, that there is any noticeable difference in the effect of the two types of coil. Practically, however, the manifold type is more liable to loss of efficiency through air binding unless connected in a manner to eliminate such difficulties.

The only way air binding can be obtained in such a coil

is by the steam travelling through one or more lines of pipe, reaching the return manifold in advance of the steam travelling by other routes and closing the air valve before the air in the slower operating pipes is expelled. If the correspondent will compare carefully the length of steam travel in the coil in Fig. 1 he will find that the steam travel from the point where it enters the supply manifold to the point where it leaves the return manifold is exactly the same length no matter which pipe is considered, the shorter pipes of the coil requiring the steam to pass through the entire length of both supply and return manifolds. Thus, a much more even travel of steam down all the pipes toward the air valve is assured and if this travel is at an exactly equal rate all the pipes will be completely rid of air and filled with steam during the same interval of time, thus insuring that at the time the steam reaches the air valve all pipes of the coil are freed of air and properly filled with steam.

In the connections shown in Fig. 2 the entering steam tends to drive down the middle pipes of the coil due to its entering velocity. While this might not be sufficient to cause serious trouble the tendency would be to heat these pipes first and to shut the air valve before the top and bottom pipes of the coil were blown out.

As for the higher evaporation at high pressure steam, of which the correspondent writes: this is due merely to the higher temperatures corresponding to the higher pressures. Since the heat transmission in radiating surfaces is dependent upon the difference in temperature between the steam or other heating medium and the air, water, etc., as the case may be; it follows that the higher the pressure and thus the temperature, the greater will be the temperature difference and the heat transmission. The flow of heat is not dependent upon the total heat or quantity of heat present but upon the degree or temperature, heat tending always to flow from a body at higher temperature to one at lower temperature until a state of equality is reached.

Heating Outdoor Water Tanks.

EDITOR HEATING AND VENTILATING MAGAZINE:

In your January issue Oscar West comments on previous calculations published for heating outdoor water tanks and states a somewhat similar problem from his own experience. However, in the calculations which follow, he seems to have neglected the exposed surfaces in top and bottom of the tank in question, from which, of course, a heat loss also occurs. This loss may not be as great at the top (due to air space) as at the bottom, but in any event the figure given of 3300 sq. ft. should be changed to 4712 sq. ft.

The B. T. U. per hour is given as 650,000 whereas this should be 643,500, the difference between the two figures giving 1.33 sq. ft. less of heating surface and worth while taking into account, since this amount is about 10 per cent of the total square feet of heating surface required. The mean temperature difference is also 141 degrees and not 140, while the last calculations for the figures given should be 15.5 sq. ft. instead of 12.5 sq. ft.

Making these corrections, but keeping to the 1500 gals. per hour of water circulated and tube transmission of 300, would change the figures throughout so that the B. T. U. per hour would be 918,840, the temperature rise of the water 73.5 degrees and the temperature of the water leaving 118.5 degrees; thus giving a mean temperature difference between steam and water of about 130 degrees while the square feet of heating surface required would be 23.5, about twice the amount as figured by the correspondent.

If 12.5 sq. ft. was the amount of heating surface actually installed by the correspondent and not just the amount as figured (in error) for the problem, it would appear from the results of these corrections, that the heating of the water would not have been satisfactory. However, the transmission of 300 from the copper tubes is conservative while the water in lowering its temperature from 45 degrees to 32 degrees would give up an amount of heat equivalent to 35 sq. ft. of heating surface and there would still be left the latent heat of 143 B. T. U. in each pound of water before it would freeze.

Apropos of the subject, the following table selected from Kents' Pocket Book gives the pounds of low pressure steam condensed per square foot of pipe:

*	Iron	Brass	Copper
50	7.5	12.5	14.5
100	18.5	38.0	43.5
150	32.2	76.5	87.8
200	48.0	128.0	144.0

*Mean temperature difference between water and steam (sensible heat) deg. F.

T. W. REYNOLDS.

New York City, N. Y.

Notes on Air Leakage Through Windows and Doors.

Significant figures showing the importance of air leakage into buildings at windows and doors were given recently by A. C. Willard, professor of heating and ventilation and head of the department of mechanical engineering at the University of Illinois, in an address before the Smoke Prevention Association, Professor Willard said:

"With a wind velocity of 13 to 15 miles per hour the leakage of air through the cracks around ordinary doors and windows has been found by test to amount to approximiately 0.15 cu. ft. of air per minute per lineal foot of crack for each mile velocity per hour. This value is based on a clearance of 1/16 in. between the moving sash or door and the frame in which it slides or moves, and the wind velocity referred to may be regarded as an average value for the whole United States during the heating season.

"This cold air leakage, or "infiltration," as it is usually called, takes place on the windward sides of a building, and an equivalent amount of air passes out on the leeward sides of the building. It will be apparent that the infiltration will, therefore, be proportional to the lineal feet of crack on the *windward* side of the building. Moreover, for window or door cracks wider than 1/16-in., or wind velocities above 15 miles per hour the leakage per mile will be more than 0.15 cu. ft. per lineal foot of crack for each mile velocity per hr. This is a much more rational basis for calculating the natural air leakage into buildings than the usual method of assuming a certain number of air changes in each room per hour.

DEFINITE AIR LEAKAGE BASIS PROPOSAL AS SUBSTITUTE FOR "AIR CHANGES."

"As an example, we may take the case of an office building or hotel with 500 windows in the front elevation. Such buildings are usually heated to 70° F. and in ordinary construction the windows are 4 ft. by 7 ft., double hung, with about 1/16-inch crack. Hence, each window, including the meeting rail, offers 26 lineal ft. of crackage. On a zero day with a wind velocity of 15 miles per hour, the volume of air leaking into the building per hour is: $0.15 \times 15 \times 60 \times 500 \times 26 = 1{,}755{,}000$ cu. ft. per hour. As each cubic foot of air weighs 0.086 lb. at 0° F. the weight of air entering at the windows per hour is: $1{,}755{,}000 \times 0.086 = 150{,}930$ lbs. per hour. Since each pound of this air must be raised from 0° to 70° F., the heating system must supply enough heat in the steam or water sent to the

radiators to do this heating. It takes 0.24 B. T. U. to raise 1 lb. of air 1° F. Heat required per hour for taking care of infiltration is:

150,930 x 0.24 x (70—0) = 2,535,264 B. T. U. per hour.

AIR HEATING LOAD ON BOILER PLANT.

Expressed in coal burned in the boilers with 60% efficiency the air heating load on the boiler plant is:

2,535,264 ÷ (0.60 x 12,000) = 352 lbs. of coal per hour.

The total heat value of 1 lb. of average coal is about 12,000 B. T. U. of which only 50% to 60% is put into the steam or water in the boiler. In a 24-hr. day the coal required for heating the air leaking into this building would amount to 8448 lbs. or 4.25 tons. If the wind velocity should increase 100% so that it becomes 30 miles per hour, the infiltration will about double and the coal required per day would amount to over 8 tons to heat this air and still keep the rooms at 70° on a zero day.

"A similar calculation may be made to determine how much coal is required for heating air when the air is supplied by fans for positive ventilation, such as is necessary in school-house work. As an example in this case, take a ten-room school with 50 pupils per room who must be supplied with 30 cu. ft. of fresh air per minute, as required by State law. The heat necessary per hour on a zero day is:

"50 x 30 x 60 x 10 x 0.24 x 0.075 x (70-0) = 1,134,000 B. T. U.

"The weight of 1 cu. ft. of air at 70° is 0.075 lbs. and the air is measured at 70° F. This amounts to 158 lbs. coal per hour or about two tons per day (24 hrs.) in addition to the heating load on a zero day."

The Use of Refrigeration in Air Conditioning.

Speaking before the American Society of Refrigerating Engineers at its recent annual meeting in New York, Lee Nusbaum, of the Pennsylvania Engineering Co., said that the use of refrigeration has become absolutely necessary in most air conditioning plants in connection with silk mills, unless they have a large supply of artesian well water around 50° F.

It was found that in summer time where the water exceeds a temperature of 65° F. in a silk mill air washer the conditions become such that the silk fibre had a tendency to snap. As most places are not fortunate enough to have a sufficient supply of cold water in summer it becomes obvious that refrigeration becomes an essential in order to make the air washer workable.

TYPICAL RESULTS SECURED.

One instance of the results obtained by air conditioning apparatus was in a plant in New England. The outside temperature was 90° and the humidity 63%. The inside temperature was 70° with 47% humidity. To obtain these results it was necessary to refrigerate the water in the humidifier to about 42°. This was done by means of Baudelot coils and direct-expansion ammonia. This type of apparatus is especially valuable where it is necessary that the humidity must be maintained constant, in addition to the temperature.

Another example is the use of air washers in connection with dough-mixing rooms in large bakeries. Many of the modern bakeries are equipped with air washers and they are able to operate these until the cooling water reaches about 70° F. with, of course, a corresponding increase in outside temperature. From this point on by the application of refrigeration to the spray water, the mixing room may be kept at the proper temperature and humidity.

In proportion to the amount of work done, the size of the refrigerating plants required for this work is relatively small and they really should be a part of any completely-designed air conditioning apparatus.

METHOD OF APPLYING REFRIGERATION

The methods of applying the refrigeration is comparatively simple. The water in the air washer is cooled by two methods. First, by running the water over a series of Baudelot coils or, second, by immersing the coils in the water pan of the air washer. Where space is limited, the second method is preferable, but it is necessary in a properly-designed plant to take care that the water is brought thoroughly in contact with the coils; this may be accomplished by means of baffles.

The coils may be refrigerated with brine or ammonia, the latter being used in most cases.

To be sure of a thorough cooling of the water a 2-in Baudelot cooler should be at least 12 pipes high. The length of the cooler is usually short due to space conditions.

The temperature of the water cooled varies according to the work to be done and the design of the humidifying apparatus, but for ordinary purposes the temperatures of the water required are from 55° to 45° F., although some plants require water as low as 38° F.

In applying refrigeration to humidifying apparatus it is necessary to figure the number of degrees the water is to be cooled and also the quantity per minute. Based on 100 gal. of water per minute through a 10° range in temperature from 55° to 45°, the speaker said he allowed 360 sq. ft. of Baudelot cooler. Suction pressures vary in the various plants from 30 lbs. to 45 lbs.

It can be seen, therefore, that one must be careful to watch closely the condenser capacity, as the refrigerating capacity of the normal compressor is considerably increased at the higher suction pressures under which these plants must operate.

FUTURE OF AIR CONDITIONING.

It was Mr. Nusbaum's belief that air conditioning apparatus will open up a new field for refrigeration eventually. The time may not be far distant he said, when public school buildings, theatres, public halls and places of assemblage will be compelled by law to be equipped with air conditioners regulating the humidity and temperature of the air breathed.

Tests are now being made trying to make an extensive comparison between temperature of the air, humidity and the germ content of the same and there is reason to believe that germs which affect the human lungs are produced or retarded according as the temperature and humidity in the air vary.

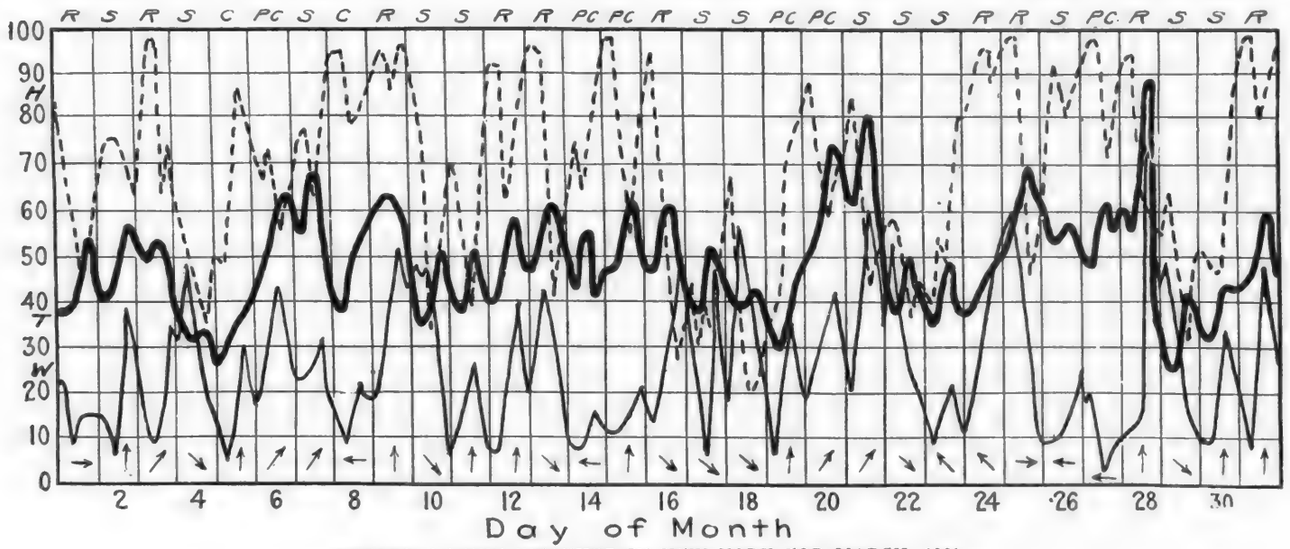
Should this ever be definitely determined, air conditioning apparatus will be essential in the places enumerated above and the absolute control of this can only be had by the use of refrigeration in connection with the same.

In conclusion, Mr. Nusbaum believed that every properly-designed air conditioning apparatus should be equipped with refrigeration in order to get the maximum results from such apparatus and to make them more effective in summer time when they are especially required and the water temperatures are high.

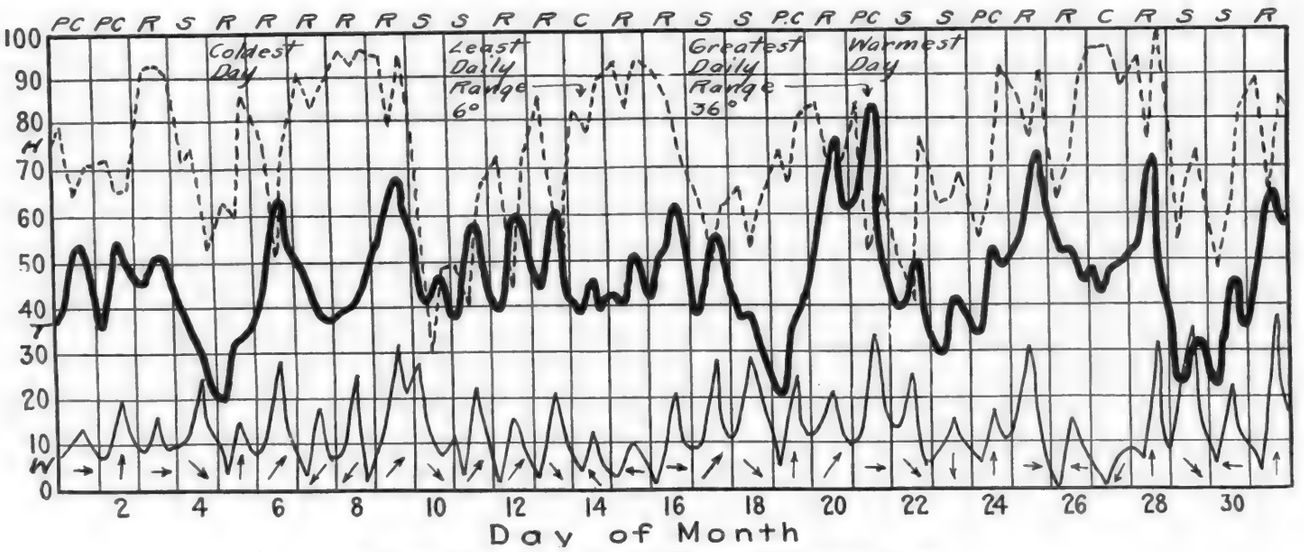
Atlas Engineering Co., Long Island City, N. Y., has been organized by W. W. Cheshire, formerly of the Fulton Co., to engage in heating and ventilating engineering and contracting, also manufacturing.

THE WEATHER FOR MARCH, 1921

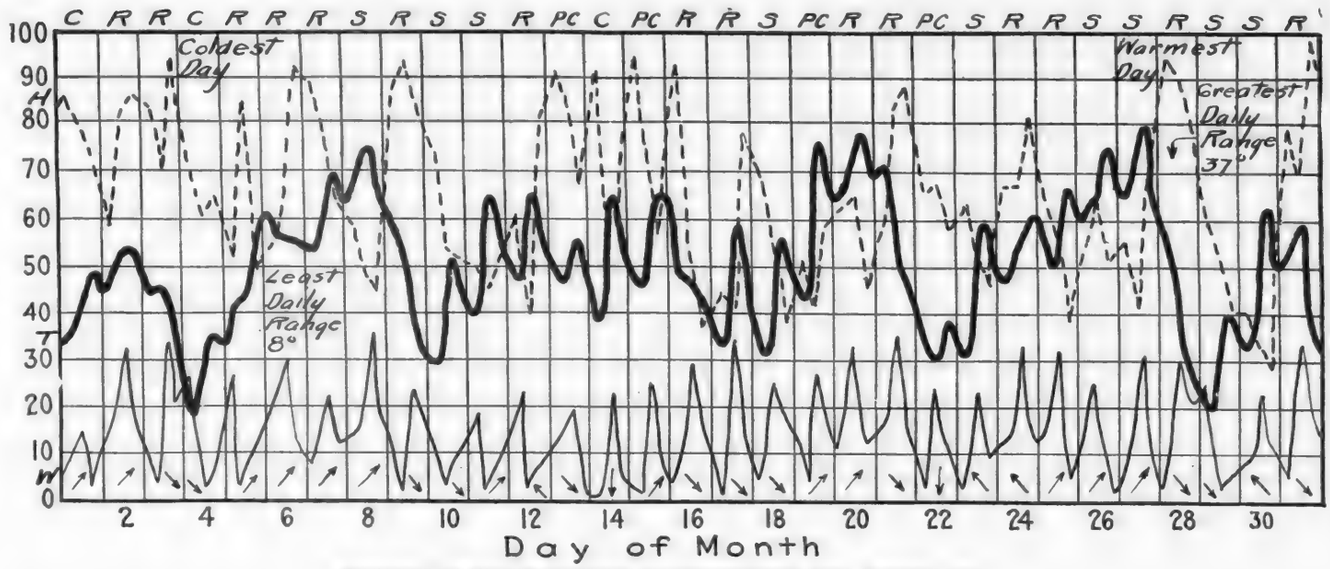
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature	80	83	80	78	81
Date of highest temperature	21	21	27	19	20
Lowest temperature, degrees F.	25	20	19	19	22
Date of lowest temperature	29	5	4	28	28
Greatest daily range, degrees F.	44	36	37	33	39
Date of greatest daily range	28	21	28	27	27
Least daily range, degrees F.	10	6	8	3	11
Date of least daily range	18	14	6	13	23
Mean temp. for month, degrees F.	48.3	46.2	50.7	45.8	54.0
Normal mean temp. for month, deg. F.	37.5	35.0	39.5	34.4	43.8
Total rainfall, in.	2.21	1.92	3.30	4.00	6.14
Total snowfall, in.	none	none	1.4	none	none
Normal precipitation, this month, in.	4.10	4.08	3.01	2.55	3.43
Total wind movement, miles	14952.	8396.	9242.	10490.	12244.
Prevailing direction of wind	S	S.W.	S. W.	S	N. W.
Number of clear days	13	9	9	9	12
Number of partly cloudy days	7	7	7	3	6
Number of days on which rain fell	10	15	15	19	13
Number of days on which snow fell	none	none	1.4	none	none
Snow on ground at end of month, in.	none	none	1.4	none	none



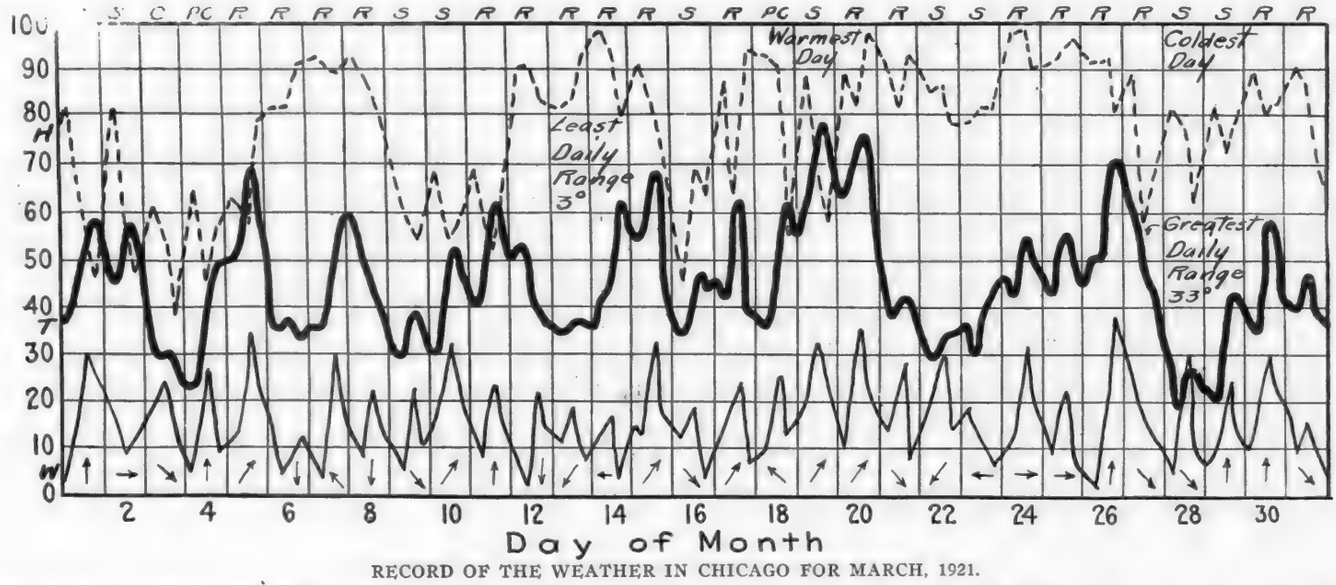
RECORD OF THE WEATHER IN NEW YORK FOR MARCH, 1921
(Hourly Observations of Relative Humidity Plotted on this Chart.)



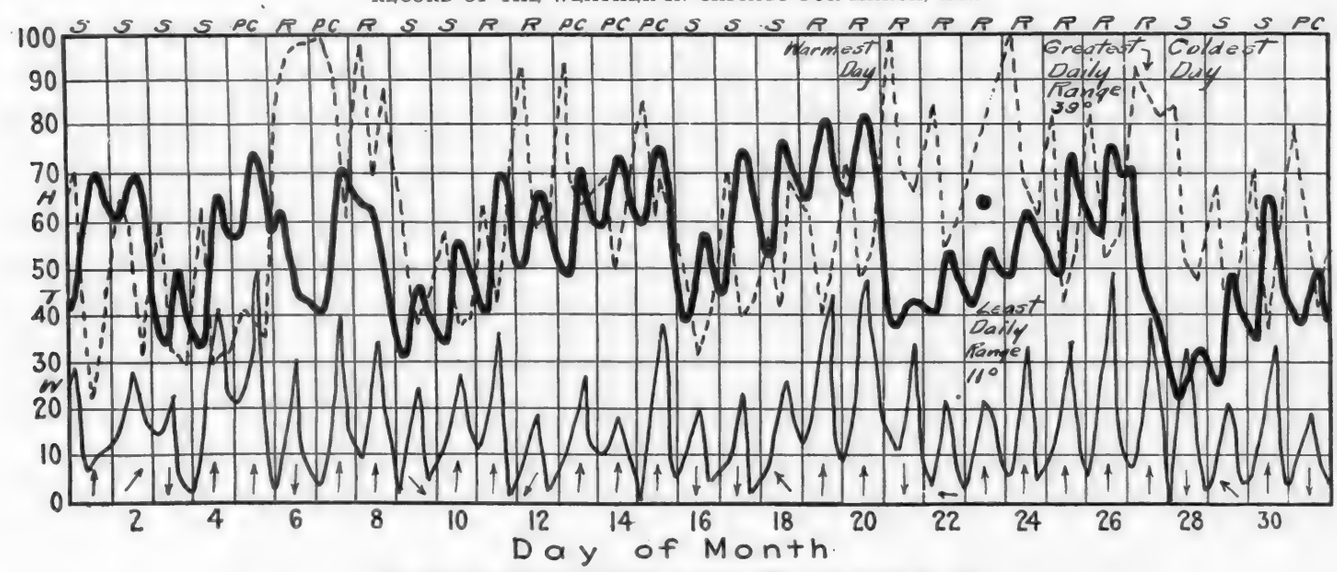
RECORD OF THE WEATHER IN BOSTON FOR MARCH, 1921.



RECORD OF THE WEATHER IN PITTSBURGH FOR MARCH, 1921.



RECORD OF THE WEATHER IN CHICAGO FOR MARCH, 1921.



RECORD OF THE WEATHER IN ST. LOUIS FOR MARCH, 1921.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United State Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings taken at 8 A. M., 12 M., and 8 P. M.
S—Clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Heat Transmission Test Room of the Research Laboratory

The accompanying illustration, which appeared in the Journal of the heating engineer's society, shows the arrangement of the cold room at the society's Research Laboratory, in Pittsburgh, in which an elaborate series of tests will be conducted to develop authoritative heat transmission factors for various building materials. It is equipped with a refrigerating machine, a humidifier, a de-humidifier and a fan. This apparatus is to be used to control, as nearly as possible, all the factors which influence heat loss under normal outside conditions.

A room of standard frame construction has been designed in which to conduct the first set of experiments. This room is 8 ft. square and 6 ft. high, with the customary spacing of joists and studding. The floor consists of a layer of rough boards, with a layer of building paper on top, and then the matched flooring. The walls on the outside consist of 1-in. lining, a layer of building paper and weather boarding. The inside is finished with lath and the usual number of coats of plaster.

There is also an opportunity of studying the effects on heat loss of papering the walls. The ceiling is plastered the same as the walls, and the roof is made of the usual sheathing, covered with cedar shingles laid 5 in. to the weather.

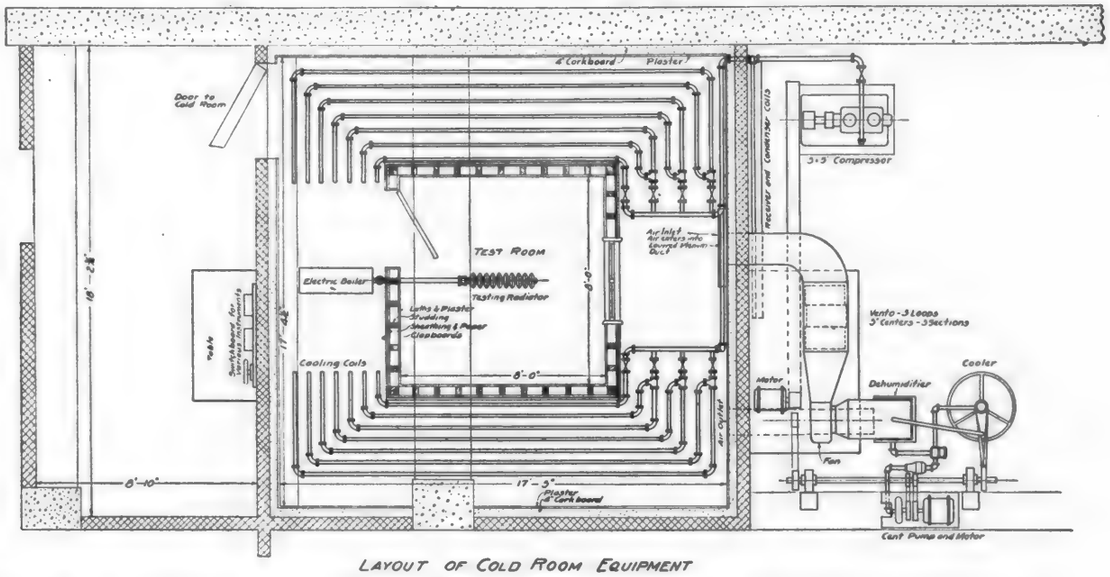
The room is heated by a radiator supplied with steam from an electrical boiler under the automatic control of a thermostat, suitably placed within the room.

The first set of experiments will be made to determine the heat loss from this room in still air throughout a wide range of temperatures and with varying humidities. A test will then be made for infiltration, which will be done by connecting the discharge of the fan to the perimeter of the side of the building containing the window, by means of a canvas hood. The pressure will then be raised through a considerable range to determine the effect of wind velocity upon this item. The standard window will then be taken out and other windows of various types of construction will be submitted to ascertain the effect of good, bad and indifferent construction, and that of weather strips, upon infiltration. There will also be a blind door and window made from wall material and well-fitted to determine air leakage through walls alone.

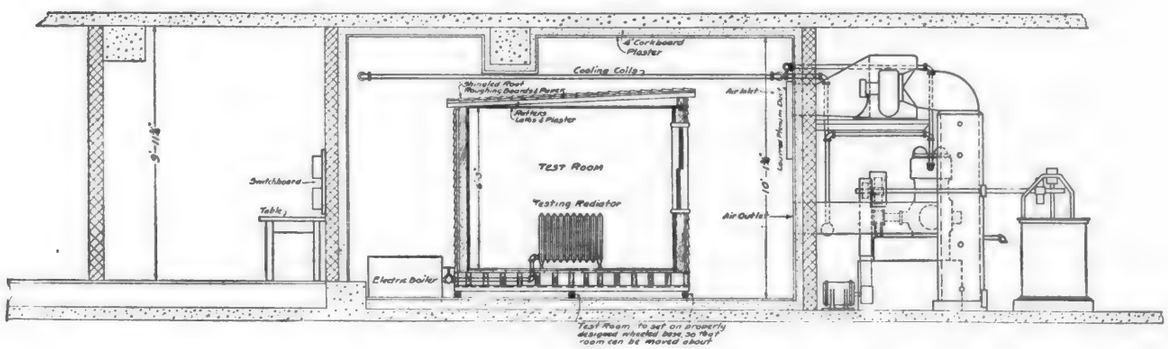
The plans include securing definite information upon the effect of a sweeping action of the wind across the outside surfaces. By combining these with the infiltration losses, it will be easy to obtain the total effect of the wind upon heat loss.

After a wide range of experiments have been performed in this manner, the standard floor and roof will be removed and other types will be substituted.

In addition to the work to be carried out on standard frame construction, other types of construction will be used, such as brick, hollow tile, stucco with inside plastered walls, or Bristol board, and various other compositions.



LAYOUT OF COLD ROOM EQUIPMENT



EXPERIMENTAL ROOM AT RESEARCH LABORATORY FOR CONDUCTING HEAT TRANSMISSION TESTS

USE OF HOT PLATE METHOD.

Another method of testing heat losses, which is being used by the Research Laboratory, is the electrical plate, air cooled. This plate has been recently completed and is now in operation at Pennsylvania State College. It is large enough to take specimens

2-ft. square and up to 4 in. thick. This plate will admit of testing materials over a wide range of temperature, humidities and wind velocities. It is hoped to develop this instrument in such a way that it can be applied directly to such walls and their heat retaining qualities determined.

Dates Extended for Summer Meeting in Cleveland

Announcement is made that four days, instead of three, will be devoted to the summer meeting of the American Society of Heating and Ventilating Engineers, which will be held next month in Cleveland. The revised dates are June 14-17. Headquarters will be at the Hotel Winton.

New York Chapter Hears Addresses on Ship Ventilation

A vivid picture of the stifling conditions prevailing in the engine and boiler rooms of ships was presented at the April meeting of the New York Chapter and the point was brought home by all of the speakers that the heating and ventilating engineer has an opportunity of helping to remedy a condition that is likely to be tolerated with less patience as the general improvement of working conditions progresses. Temperatures of 125° F. in engine rooms, it was shown, are quite the usual thing, while it is not uncommon to experience at times temperatures as high as 168°.

There was general agreement among the speakers that the ship owners are the ones to approach in effecting reforms, rather than the dry-dock repair men or the marine architects. The need of securing the utmost amount of cargo space was an important barrier in providing for better ventilation. There was divided opinion as to whether the reforms were to be best effected by laws or education.

F. R. Still, of the American Blower Company, presented the subject in a carefully-prepared paper in which he stated that the battleships afford the best examples of the possibilities of ship ventilation. In passenger ships the quarters most in need of ventilation are the steerage. While on the sea it is not difficult to ventilate ships, but it must be remembered that fully 50% of the time is spent in port.

A start was made in the LaFollete law to take care of seamen and crew. This law, declared Mr. Still, needs amendment or the merchant marine of this country will disappear. He said that part of the law dealing with the ventilation of the crews' quarters was reasonable.

He then took up the usual methods followed in ventilating ships. The supply fans, he stated, are ordinarily placed on the promenade deck, while the exhaust fans are to be found all over the ship and great dependence is placed upon the latter in maintaining the desired conditions. Unusual ruggedness of construction is followed in the design of the fans and housing.

It is evident, he said, from the layout of the ducts, that air distribution is not properly studied. Air can be driven through ducts on board ship at higher velocities than on land, as noise is not so important a factor. It is common practice to carry velocities as high as 2000 to 2400 ft. per minute in the main ducts, and 900 to 1200 ft. per minute in the branches. Due to the scant space between decks the air flues have to be made very shallow, not over 10 or 12 in. They are, however, of unusual width.

Cattle ships, said Mr. Still, were not ventilated before the World War. The need of such ventilation is great as the deaths of the animals without ventilation is appalling. During the war cattle ships were ventilated and he felt this practice should be continued.

On passenger ships the greatest need is for the circulation and cooling of the air. For that reason it is not uncommon, especially on the Great Lakes steamers, to find standard air-washers installed. In the case of ships carrying perishable freight ventilation is a business proposition.

If the largest steamship companies should effect a combination, it would be much easier to secure better ship ventilation but as matters stand, there is a long way to go before substantial reforms can be accomplished.

H. A. Erickson followed with a paper on "The Ventilation of Engine and Boiler Rooms of Merchant Steamers." He told of some of the observations he had made during a trip on one of the Shipping Board's steamers to China and return. Entirely inadequate provisions were made, he said, to supply fresh air to engine and boiler rooms, with the result that almost unendurable conditions were the rule, especially during periods of calm and when in port. He urged the society to take a stand on the matter and make its influence felt in bettering conditions.

A. Steinmetz, manager of the export and marine department of the American Blower Company, also spoke, supplementing the points made by the previous speakers.

The election of officers of the chapter resulted as follows: President, A. S. Armagnac; vice-president, W. H. Carrier; treasurer, William J. Olvany; secretary, J. E. Bolling. Board of managers; the officers and W. L. Fleisher, G. A. Dornheim and W. L. Durand.

On the suggestion of President Champlain L. Riley, a motion was passed providing for the appointment of a conference committee on chapter subjects to co-operate with the different chapters in securing subjects that could be discussed simultaneously by them all.

It was voted to make the May meeting non-technical, with a dinner and entertainment features.

Illinois Chapter Takes Up Exhaust vs. Live Steam for Heating

Exhaust vs. live steam for heating came in for a lively discussion at the April meeting of the Illinois Chapter, which was held at the Chicago Engineers' Club, April 11. Included among the guests were ten members of the Chief Engineers' Association of Chicago.

Edmund R. White, special agent for the Aetna Casualty and Surety Company, and Lloyd Howell, of the American District Steam Company, were the two principal speakers. Mr. White spoke from the standpoint of the operating engineer and indicated from his experience of many years in connection with the Masonic Temple building in Chicago, that exhaust steam was more efficient for heating than live steam at reduced pressure. He attributed this, to some extent, to the pulsating action of the engine pushing the steam into the pipe, in addition to the pressure drop through same. He did not attempt to prove his contention, due to the lack of information on the use of both live and exhaust steam for exactly the same conditions.

Mr. Howell discussed the subject from the standpoint of using live steam at reduced pressure. His paper contained, among other things, a series of statements from operating men which tended to show that exhaust steam was more efficient than live steam at reduced pressure. However, Mr. Howell indicated that from a theoretical standpoint live steam at reduced pressure should be more efficient than exhaust steam of the same pressure, due to the relative quality of the steam.

A lively discussion followed the reading of the papers, especially from operating engineers of some of the large buildings in Chicago. Mr. Lehn, of the Conway Building, and Mr. Camp, engineer for the new Federal Reserve Bank Building, indicated that their experience showed exhaust steam to be more efficient, although no attempt was made to give a scientific reason for this phenomenon.

Before the main subject for the evening was taken up, the following were elected members: John Hansen, C. E. Bronson and J. H. McCauley.

A report was called for from the committee recently appointed to co-operate with Senator Carlson on the matter of a State ventilation bill. Chairman Harry N. Hart reported that the Chicago Commission on Ventilation is investigating the Carlson bill and is co-operating with Senator Carlson to get the right sort of a law passed.

Among the guests who spoke were John F. Hale, of Philadelphia, and Secretary C. W. Obert of the society, who stated that new society chapters are being formed in Seattle, Omaha and Washington, D. C.

The meeting was then turned over to the committee in charge, consisting of G. D. Luce, chairman; E. G. Kohlbry, I. N. Soper and R. M. Ensign.

St. Louis Chapter Witnesses Test of School Equipment

An all-day test of the heating and ventilating apparatus in the Bryan Mullanphy School in St Louis, was made under the direction of L. A. Scipio, acting director of the heating engineers' Research Laboratory, and his assistant, O. W. Armspach, in connection with the April meeting of the St. Louis Chapter, April 14. The test was made in accordance with the Hill synthetic air chart. It will require a number of laboratory analyses of the air samples procured before the results can be learned, but it was stated that a full report will be given out as soon as it is ready. At the conclusion of the test, in the evening, the members held a formal session at the school, with Vice-president William Sodemann in the chair. Over 100 members and guests were in attendance.

In welcoming the members Commissioner of Schools R. M. Milligan stated that the chapter could have the keys to all the schools at any time for the purpose of making tests and that the Board of Education would assist whenever possible.

Secretary C. W. Obert, of the heating engineers' society, was among the guests and addressed the meeting, recounting the rapid progress made by the society during recent years, leading up to the organization of the Research Laboratory in Pittsburgh. He stated that the subscriptions for the support of the laboratory are expected to total at least $22,000 per year for the next five years and that it was a real benefit and not a drain to the society. He also spoke of the efforts that are being made to bring the various chapters in closer touch with the society and with each other.

Professor L. A. Scipio stated that he considered the St. Louis schools superior to all others he had seen, being especially impressed with the appointments of the kindergarten rooms. Professor Scipio was asked to say something of his experiences in Turkey and of the methods of heating in that part of the world. He stated that charcoal was the principal fuel and was used by all classes. It is easily made but it required considerable knack to start fires with it in the receptacles used.

In Smyrna, in one or two of the colleges he visited, it was a common sight to see the students gathered in a room with one open charcoal fire, the outside temperature being about 5° F. It was necessary for them all to wear wraps.

He gave an outline of the methods adopted for heating the Roberts College buildings, hot water being used, with small pipe sizes. It was found necessary later to change the installation to a two-pipe steam system. In running the mains from the central station, he said they had to tunnel through solid rock so that the job could work by gravity, it being impossible to procure a pump.

Other speakers were Mr. Armspach, who discussed the development of the study of ventilation, referring particularly to the value of the society's synthetic air chart, and Edwin S. Hallett, chief engineer of the St. Louis Board of Education, who declared it to be his ambition to make the air in school buildings the purest that could be had. He stated that he was willing to devote the balance of his life to the advancement of the Science of heating and ventilation and that numerous additional tests similar to that just completed would be carried out in other St. Louis Schools.

NATIONAL DISTRICT HEATING ASSOCIATION

Program for Annual Convention

Plans are well under way for the twelfth annual convention of the National District Heating Association, which will be held June 22-24, at Cedar Point, O., widely known as the "Atlantic City of the Lakes." It is especially announced that there will be no exhibit this year and special stress will be put upon the program and entertainment.

The first session will be held at "The Breakers," Wednesday morning, June 22, when President J. L. Hecht will deliver his address. This will be followed by various reports, concluding with a paper by S. Morgan Bushnell on "Insurance Rates as Affected by District Heating Installations."

In the afternoon of the same day reports will be presented on auxiliary gas heating (H. H. Clark, chairman) heating research (J. J. Donnelly, chairman) meters and accessories (R. C. March, chairman), followed by the report of the nominating committee.

The program for the subsequent sessions is as follows:

THURSDAY MORNING, JUNE 23.

Paper, "Does the Installation of Electric Generators in Connection with Steam Heating Pay?" by J. C. Hobbs, Pittsburgh.

Paper, "Experience with Non-Condensing Turbines in Industrial Heating Work," by R. D. De Wolf, Rochester, N. Y.

Report of Station Operating Committee, F. B. Orr, chairman.

THURSDAY AFTERNOON, JUNE 23.

Symposium on mechanical stokers and their performances.

Paper, "Use of Pulverized Coal," by Henry Kreisinger, Chicago.

Address, "The Coal Situation," by George H. Cusing, managing director, Coal Operators' Association.

FRIDAY MORNING, JUNE 24.

Report of Public Policy Committee, D. L. Gaskill, chairman.

Report of Committee on Rates, F. A. Newton, chairman.

Paper, "Hot Water Rates," R. A. Hetibrink, Ellwood, Ind.

FRIDAY AFTERNOON, JUNE 24.

Paper, "Customers' Installations," by Walter J. Kline, North Tonawanda, N. Y.

Paper, "Advantages of Central Station Heat from the Viewpoint of the Building Manager," by E. S. Schultz, Chicago, Ill.

Election of Officers.

Program for Heating Contractors' Annual Convention

Committees of Boston heating contractors are busy putting the final touches on the plans for the forthcoming annual convention of the Heating and Piping Contractors' National Association, which will meet at the Hub City, May 30 to June 2, headquarters being at the Hotel Brunswick, Copley Square.

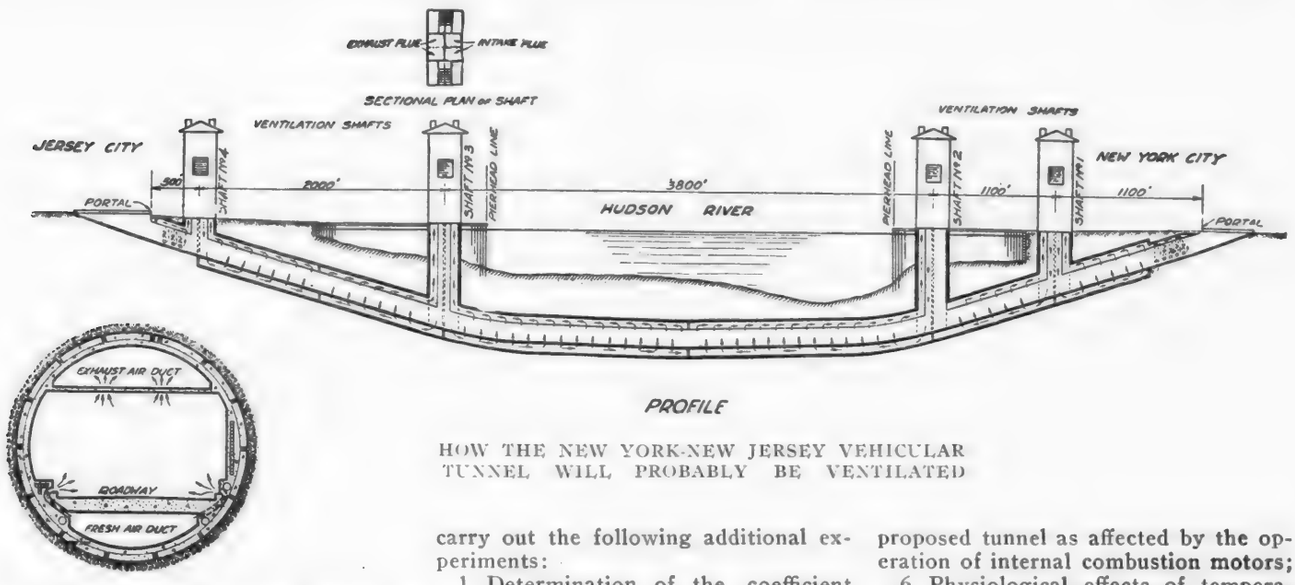
The formal opening of the convention will take place Tuesday morning, May 31, when it is expected that the speakers will include Governor Channing H. Cox of Massachusetts, Mayor Andrew J. Peters of Boston, and President J. E. Rutzler of the association. At the Wednesday morning session, June 1, it is expected that Senator George W. Cartwright of California will deliver an address.

The entertainment features will include an automobile ride, Tuesday afternoon, through Boston and along the North Shore to Marblehead Neck, thence to New Ocean House, at Swampscott, where dinner will be served. On Wednesday evening, June 1, an informal dance will be held at the Copley Plaza Hotel.

Convention of National Warm Air Heating and Ventilating Association.

The program has been completed for the eighth annual convention of the National Warm Air Heating and Ventilating Association, which will be held in Cleveland, at the Hotel Winton, May 24. The convention which will last throughout the day, will conclude with a dinner at the hotel. Among the papers to be presented are "The Use of Fans in Home Heating," by J. D. Spurier, Detroit, Mich., and "A Foundry Problem," by W. H. Barr, Buffalo, N. Y.

There will also be a discussion of areas and surfaces of warm-air heaters, led by J. M. McHenry, of St. Louis,



HOW THE NEW YORK-NEW JERSEY VEHICULAR TUNNEL WILL PROBABLY BE VENTILATED

Mo. One of the principal reports to be presented at the afternoon session will be that of the Advisory Committee on Warm-Air Furnace Research, P. J. Dougherty, Utica, N. Y., chairman; and Professor A. C. Willard, director, Urbana, Ill.

Method Adopted for Ventilating the New York-New Jersey Vehicular Tunnel

Details of the method which has been adopted for ventilating the New York-New Jersey vehicular tunnel, now under construction, are given in a recent report prepared by Clifford M. Holland, chief engineer for the Tunnel Commissions. As already stated in these columns, the distribution method of air supply will be followed whereby fresh air will be admitted through numerous openings on each side of the tunnel near the level of the roadway, and the exhaust air drawn out through openings at the top. The fact that the tunnel is so long, being 8300 ft. between portals and 3800 ft. between river shafts, has furnished, as stated in the report, "a problem in ventilation unlike any heretofore solved, both in character and magnitude."

A very good idea of the magnitude of the project may be gained from the statement, that the traffic is estimated at 1900 vehicles per hour, requiring an air supply of 1,833,906 cu. ft. in one tube and 1,782,699 cu. ft. in the other.

The principal questions remaining to be decided are the practical working out of the various details of the scheme outlined and the power required to move the air through the ducts. It is also planned to conduct further experiments so as to be able to make comparisons, in the design of the tunnel, of the additional cost of construction due to an increase in the size of the air ducts with the resulting saving in operating charges.

An agreement has been reached with the United States Bureau of Mines to carry out the following additional experiments:

1. Determination of the coefficient of friction to flow of air in concrete ducts;

2. Verification of formulas used in computation of power required for moving air through a duct from which air is taken off at intervals;

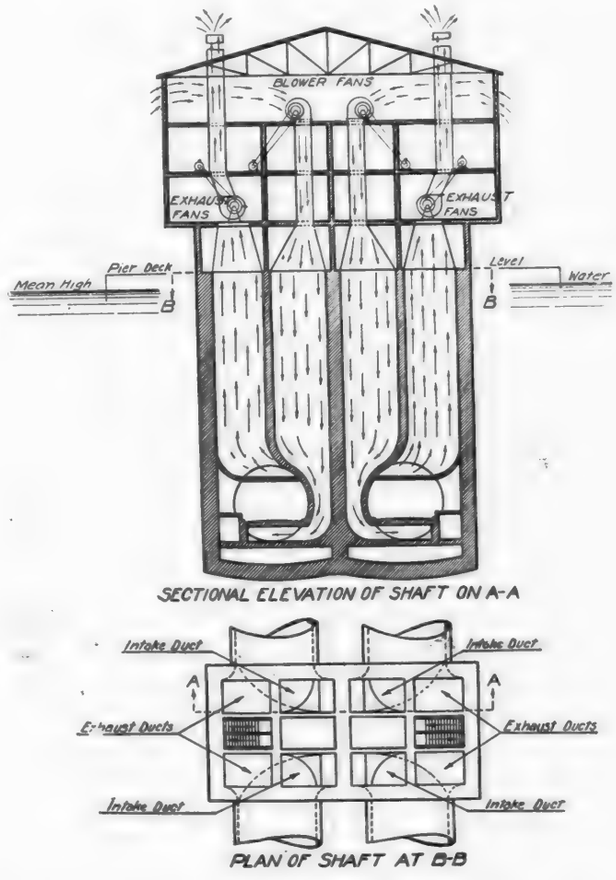
3. Determination of power losses in bends;

4. The diffusion of exhaust gases in the cross section of the tunnel;

5. Temperature conditions in the proposed tunnel as affected by the operation of internal combustion motors;

6. Physiological effects of temperature, exhaust gases, and smoke in the tunnel section under operating conditions.

Experiments listed under 1, 2 and 3 will be made at the Engineering Experiment Station of the University of Illinois, while those listed under 4, 5 and 6 will be made at the experimental mine of the Bureau of Mines of Pittsburgh. The tunnel, it is expected, will be finished by 1924.



RIVER VENTILATING SHAFT FOR NEW YORK-NEW JERSEY VEHICULAR TUNNEL

PRESENT STATE OF THE ART IN SMOKELESS BOILER CONSTRUCTION

No. 27—Capitol Smokeless Boiler.

General conditions requisite to the construction of smokeless boilers were suggested several years ago by D. T. Randall, of the Bureau of Mines, as follows:

1. Coal should be supplied to the furnace in small quantities at frequent intervals. The more nearly the feed approaches a continuous and uniform supply, the better the results.

2. Air supply should be slightly in excess of the theoretical amount required and should be admitted principally through the fuel bed, with an auxiliary supply admitted at the front or rear of the furnace to burn gases from the coal.

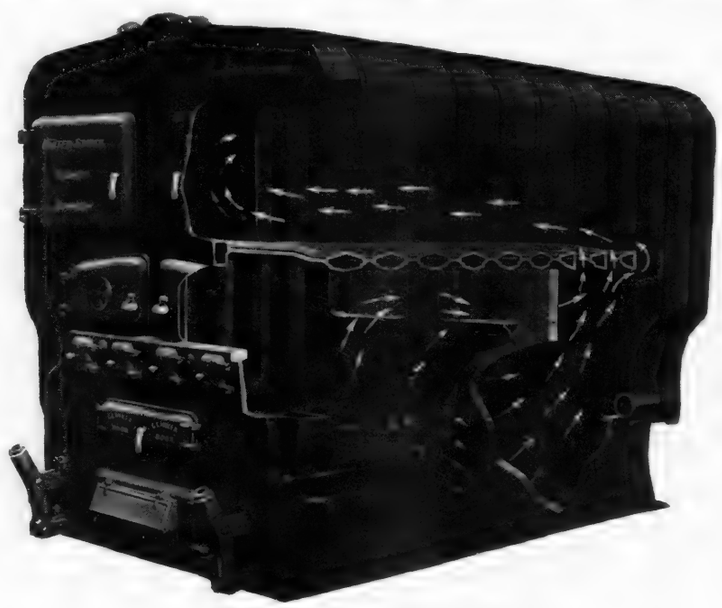
3. The temperature in the furnace should be sufficiently high to ignite the gases given off from the fuel bed.

4. There should be a fire-brick combustion chamber of ample dimensions and so designed as to cause the thorough mixture of the gases and air, permitting complete combustion before the mixture reaches the boiler surfaces.

The Capitol smokeless boiler, manufactured by the United States Radiator Corporation, of Detroit, Mich., was designed to meet the above requirements for smokeless operation and was one of the first steps away from the down-draft principle for boilers with this operating characteristic.

Of cast-iron sectional construction, the Capitol boiler, as shown in the accompanying illustration, is seen to carry a commodious fire-box with double grate, each grate section being equipped with independent shaking mechanism. Primary air supply is admitted through the grate and fuel bed, while an auxiliary air supply, admitted at the front of the furnace, mixes with the volatile gases distilled from the fuel and aids in the complete combustion of these gases. Gases pass from the fuel bed back through two horizontal openings at the top of the bridge wall into a mixing chamber and from there through a long vertical opening in the ignition wall into the combustion chamber. This ignition wall of fire-brick has a fusing temperature of 2700 degrees F. and, since the temperature of the burning gases is several hundred degrees below that temperature, the wall gives long service. Constant contact with these hot gases maintains this ignition wall, during operation of the boiler, at a temperature of about 1600 degrees F., or approximately 400 degrees F. above the ignition temperature of the gas mixture, which means that combustible gases cannot contact with the ignition wall without being ignited. Failure to contact is prevented by the fact that the opening from the mixing chamber to the combustion chamber, also shown in the sectional view, is through a vertical slot that is a trifle smaller in area than the opening from the furnace into the mixing chamber and the gases are therefore held for a few seconds and washed against the ignition wall. Combustion is completed in the combustion chamber before passing into the boiler flues.

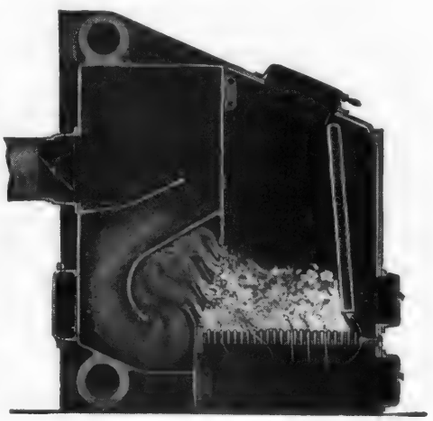
The manufacturer's claim for this boiler is that it will operate well on any of the bituminous coals, including Western lignites, and that no skilled attendance is required in order to secure smokeless operation.



CAPITOL SMOKELESS BOILER.

No. 28.—Thompson Boiler with Adjustable Magazine Furnace.

The Thompson boiler, manufactured by the Thomson Heater Corporation, of Buffalo, N. Y., is admitted by its makers to be a radical departure from the usual construction of low pressure, heating boilers. They feature specially the claim that in this boiler the functions of burning the fuel and of heating or evaporating the water have been designed separately for maximum efficiency. Some of the advantages claimed for the design having the furnace where the fuel is burned, separate from the boiler where the water is heated, are: first, that the fuel capacity may be increased without increasing the size of the boiler; second, that the furnace may be adjusted to burn through any desired fuel thickness to accommodate fuels of various densities; third, that the furnace may be adjusted to burn any kind of fuel, without changing the boiler in any way. The boiler may operate one year on stove coal, another year on buckwheat coal, and a third year on soft coal. To change from one variety of coal to another, it is necessary to change the shape and size of the furnace only—a very simple operation; and fourth, that when a furnace is specially designed for a special kind of fuel, greater fuel economy is possible.



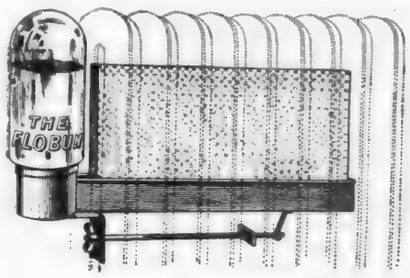
THOMPSON BOILER WITH ADJUSTABLE MAGAZINE FURNACE.

In the accompanying sectional view is shown a side elevation of the Thompson boiler which is largely self-explanatory. The magazine feed is seen to be adjustable by means of the swinging front wall. No matter how many sections may be assembled the stoking depth remains constant because the sections are added laterally rather than longitudinally as in the usual cast-iron sectional construction. Each grate bar is arranged for separate shaking and this consists in a complete rotation rather than a rocking motion. These grate bars are water-cooled to prevent burning out. This boiler is also equipped with a gas-burning attachment which can be operated entirely independent of the coal operation. By this means the boiler can be operated with gas only, or with coal only, or with gas and coal together, according to the capacity required.

HUMIDIFYING DEVICES FOR THE HOME

No. 1—Flobun Humidifier

The Flobun humidifier shown in the accompanying illustration, is a device for use on individual radiators for humidifying the air at the same time it is being heated. This equipment feeds water by syphon action from a sealed air-tight container into a metal trough containing a vertical wick which presents a large evaporating surface. This wick draws up water from the trough by capillary action and this water is evaporated by the heated



FLOBUN HUMIDIFIER.

air from the radiator. The wick is located between radiator coils at the point where heat is most intense and its large surface exposed continuously on both sides, feeds a lot of water vapor into the room. There is no vegetable matter in this wick to decompose and give off foul odors.

The evaporation claimed for this humidifier is from two to four quarts of water per day and the capacity of the glass container is two quarts, so that this requires refilling once or twice a day, depending upon the rate at which the radiator is operating. Advantages claimed for it are a simple and sanitary design, with no open pan to collect dust and dirt, and with no complicated parts to give mechanical troubles. It is unobtrusive and sightly in appearance and can be installed on any multiple column radiator which is open at the ends and has a space of ½ in. or more in width and 8 in. in height between columns. The Flobun Humidifier is manufactured by the Minneapolis Heat Regulator Co., Minneapolis, Minn.

No. 2—Buddington Humidifier

Excepting the good old-fashioned pan of water (which is always either bone dry, or else too wet because it has tipped over), it would be hard to find a humidifying device mechanically simpler than the Buddington humidifier made by the Geo. W. Diener Mfg. Co., Chicago, Ill. In spite of its apparent simplicity, this device is scientifically designed for the purpose it serves. Within the oblong metal box, shown in Fig. 2, perforated wings hold specially woven wicks out from each side of the central water container. One edge of each

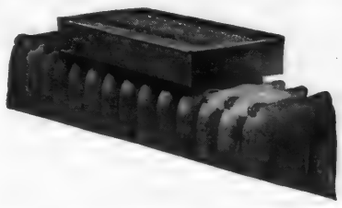


FIG. 1—BUDDINGTON HUMIDIFIER.

wick is in the water; the other is out on the wings through which is drawn the warm air which gives evaporation.

Buddington humidifiers are made in sizes of 14, 18, 28 and 36 in. length, the 18 in. size being suggested for

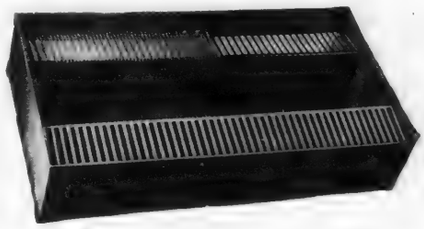
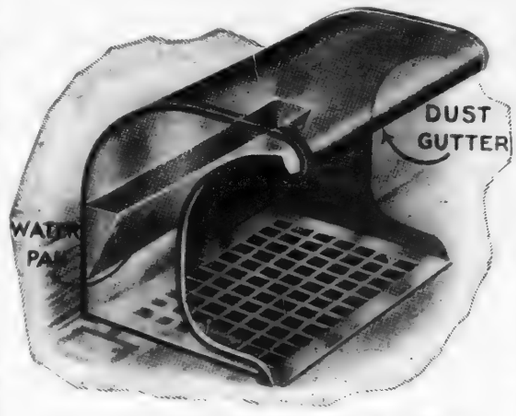


FIG. 2—VIEW SHOWING CONSTRUCTION.

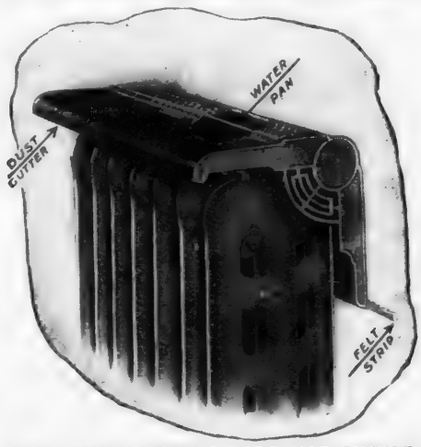
rooms of about 2250 cu. ft. air content. One humidifier of this size is claimed to evaporate from four to six quarts of water every twenty-four hours. The Buddington humidifier simply rests on top of the radiator, without attachment.

No. 3—Acme Humidifying Radiator Shield

Combining art with utility, the Acme radiator shield designed primarily for the purpose of reducing the flow of dust and the discoloration of walls and hangings resulting therefrom, serves another purpose scarcely less important in the promotion of increased interior humidity. This shield is meant to be fixed more or less permanently to the radiator, as shown in Fig. 1, and consequently the water pan must be filled from a pail or other container at the required intervals. Evaporation in this case is simply from the surface of the water, the principal advantage over the old fashioned water pan being that this one can not tip over and does not present the same informal appearance. The provision of a similar humidifying arrangement for register shields is illustrated by Fig. 2. Both devices are manufactured by the W. H. Johnson & Son Co., Indianapolis, Ind.



ACME HUMIDIFYING REGISTER SHIELD.



ACME HUMIDIFYING RADIATOR SHIELD.

A National "Build-Your-Home-by-Thrift" League Proposed

A movement has been inaugurated by Building Supply News to organize a national "Build-Your Home-by-Thrift" League, with representatives and a branch in every town and city, with a view of affording a common and continuous point of contact for all civic and industrial organizations in any wise related to the field of home construction. Neither dues, assessments, or other obligations are contemplated, the intention being to make the league a purely voluntary medium of suggestion, publicity and inspiration.

Two practical methods are suggested to start the movement, one being the organization of an immediate and permanent "own-your-home" exposition, similar to those which have been so successfully held recently in Chicago, St. Louis, New York, Omaha, Minneapolis and Philadelphia.

The second suggestion is to develop a nation-wide home-savings thrift program that will secure the enlistment of millions now living in cramped flats and congested tenements.

American Public Health Association has moved its headquarters from Boston to New York, taking quarters in the Penn Terminal Building, New York. As already announced, the association will hold its next annual meeting in New York, November 14-18.

Charles B. Thompson, president of the Ice Trade Journal Co., New York, publisher of Refrigerating World, who died of pneumonia recently, was known to many in the heating trade. He was already prominent as an editor and publisher of trade papers when he acquired control of the Ice Trade Journal Company, in 1913. He was 42 years old.

What is a Kal?

H. A. Dresbach, chairman of the Points of Interest Committee of the New York Building Superintendents' Association, gives the following explanation of a "Kal" in a recent bulletin of the association:

Kal is a term used by the local steam supply company (the New York Steam Company) and applies to the steam being sold at a fixed rate per thousand kals under five classes of service. A kal is 1 lb. of water evaporated into steam or 1 lb. of steam condensed into water.

As a large quantity of water may be delivered with the steam, Mr. Dresbach claims that this method is open to criticism on that ground.

At present the New York Steam Company has five classes of service and rates as follows:

Contract "A." General service (not available for auxiliary or emergency heating service).

Contract "B." Annual power service (twelve months or less).

Contract "C." Apartment house service (also available for emergency or heating service).

Contract "D." Summer power service (from April 1 to November 1).

Contract "E." Auxiliary or emergency heating service (heating season from October 1 to June 1).

Rates are variable in all classes, depending upon the quantity of steam contracted for, plus a surcharge based on the cost of coal above the following prices alongside the company's docks: Anthracite coal, $2.85 per gross ton; bituminous coal, $4.50 per gross ton.

1 cu. in. of water will produce almost 1 cu. ft. of steam or vapor 34.5 lbs of water per hour evaporated from and at 212° F. equals 1 H. P. 1 H. P. will supply 138 sq. ft. of average cast-iron radiation under normal conditions and proper installation. Under these conditions 4 sq. ft. of radiation is required to condense 1 lb. of steam per hour, equal to 34.5 x 4 = 138 sq. ft. radiation.

NATIONAL TRADE EXTENSION BUREAU

Uniform Contract Form for the Heating Contractor.

The uniform contract form for heating contractors is a recent product of the Trade Extension Bureau in its nation-wide campaign for standardization of methods and for improvement of business in the heating trade. The Bureau's explanation of this new form is given in the following reprint from its Monthly Service Bulletin:

"This form carries with it all of the conditions and is recommended as adopted by the Heating and Piping Contractors' National Association. Much credit is due that organization, for the major portion of the conditions and terms included in the contract form herewith produced.

"The Bureau recommends that over printing on these contracts be eliminated. That is, it is our opinion that the heating contractor will have less difficulty in getting signatures to this contract, if his own name, or his firm's name is eliminated from the top.

"Printed in the form recommended, the heading would indicate that it is a "uniform contract form" adopted by a national organization and by using a uniform contract of this character, the average buyer will take it for granted that all of the conditions printed on the back of the contract are standard conditions and therefore accept them without argument."

On the reverse side of the form is printed the set of standard conditions which is also reprinted herewith. These forms are now available on application to the Trade Extension Bureau, Evansville, Ind. They are furnished in pads of 50 sets (original and duplicate forms) to the pad, at $1.25 per pad or $2.50 per hundred sets. The Bureau requests that remittances accompany orders.

STANDARD CONDITIONS ADOPTED BY THE NATIONAL TRADE EXTENSION BUREAU FOR STEAM, HOT WATER, AND BETTER HEATING INSTALLATIONS

No. 1. Payments are to be made monthly on a basis of 90% of the value of labor and materials furnished during the preceding thirty days. The remaining 10% to be paid on completion of the contract.

No. 2. It is expressly stipulated and agreed that the ocntractor shall not be liable for any delays occasioned bv the acts of the elements, strikes, fires, inclemency of the weather, the acts of other contractors, or any other contractors, or any other causes beyond his control.

No. 3. The owner or agent shall provide sufficient space on the premises where this contract is to be executed for the storage of the material and the proper prosecution of the work.

No. 4. All material and labor required to complete the work and not included in this proposal shall be furnished by the owner or his agent in such manner as not to delay the progress of the work.

No. 5. Unless otherwise provided for, the contractor shall do all cutting through walls or floors for the installation of this work and finishing around same after work is completed.

No. 6. The contractor will guarantee the installation against original defects of material and workmanship for a period of one year from the date when the heating plant is ready for practical use. The contractor agrees to replace without expense to the owner, except transportation and board for men, any part requiring replacement within the period stated above, due to inherent defects of material and workmanship. Be it understood that the contractor will not under any condition pay for any labor or material, or any defect other than repaired by his own men. The liability of this matter extends only to the labor and material furnished by the contractor and does not cover any contingent liability either to buildings, contents, products or persons.

No. 7. If the work covered by this proposal includes the installation of material and apparatus under specifications made by others, the performance liability is not assumed by the contractor. Should the contractor guarantee temperatures or operation of this system and tests be required, such tests shall be made by the contractor under standards established by the American Society of Heating and Ventilating Engineers.

No. 8. If upon completion of the work covered by this proposal, weather or other conditions over which the contractor has no control, do not permit of a proper test, this shall not be considered a sufficient reason for withholding payment.

No. 9. This proposal is based on the prevailing rate of wages and the execution of the work during regular working hours.

No. 10. It is hereby expressly provided that the title to the material to be furnished by the contractor under this proposal, shall be and remain in the contractor until all sum or sums of money called for in this proposal, and required to be paid by the owner, are fully paid the contractor in legal tender of the United States; and that until said sums of money are so paid, said material shall be, and by the signing of the acceptance hereof, it is agreed that they shall be and remain personal and moveable property in whatever manner they may be annexed to realty and that in case of default in the payment of any of the instalments provided for in this proposal, the contractor is hereby authorized to enter upon said premises and to take possession of and remove said material at any time and that in such event the contractor shall have the right to retain as rental for the use of said material, any sum or sums of money that may have been paid by the owner; and that all expenses incurred by the contractor by litigation arising out of and caused by failure to make the payments as herein provided for, shall be paid by the owner.

No. 11. Water supply connection for feeding heating plant, unless especially mentioned in the specifications as a part of the contractor's work, shall be supplied by the owner at his expense.

No. 12. Sewerage or blow-off connections for the heating plant, unless especially mentioned in the specifications as a part of the contractor's work, shall be supplied by the owner at his expense.

No. 13. Service pipes, returns, and air lines from central heating mains in street to point where same enter basement will be treated as an extra unless specially mentiond in the specifications as a part of the contractor's work.

No. 14. The owner shall furnish and deliver in furnace room all fuel required to test the apparatus, if such test is required.

No. 15. The signer of the acceptance hereof hereby acknowledges that he or she is the sole owner o fthe property in which this contract is to be executed, or that he or she has been authorized to sign same for all parties interested in the property; and he or she further declares that the property is and shall remain free from mortgages or other encumbrances that can affect the carrying out of the conditions herein set out.

No. 16. Should the owner or his agents, contractors or others acting under them, desire to use any part of the apparatus covered by this proposal prior to the acceptance, permission is hereby granted upon the following conditions:

That the apparatus is to be operated entirely at the owner's risk and expense, and delivered to the contractor again in as good a condition as found. If the apparatus is required for temporary heating, an additonail charge will be made for any extra material that may be required or labor required in connecting and disconnecting radiators.

No. 17. The owner shall provide a chimney of proper dimensions and draft for the apparatus proposed herewith.

No. 18. Any dispute arising under a contract based on this proposal that is not settled within thirty (30) days. shall be referred to two arbitrators, one selected by each party to the contract. Should they be unable to agree, they shall select a third arbitrator. The decision of a majority of these arbitrators must be given within sixty (60) days from the date of reference, and shall be binding on both parties to the contract; one-half the cost of arbitration to be paid by each party to the contract.

No. 19. It is further agreed that in case there is an advance or decline in the price of labor by reason of labor conditions covering the territory in which the building is located and which are beyond the control of the contractor, then the amount to be paid under this contract shall be increased or decreased accordingly.

New Apparatus and Appliances

Holmberg System of Vacuum Vapor Heating

The basis of this system of steam heating is the Holmberg improved steam trap, a sectional view of which is shown in Fig. 1. It is claimed by the manufacturers that one of these traps will take care effectively and

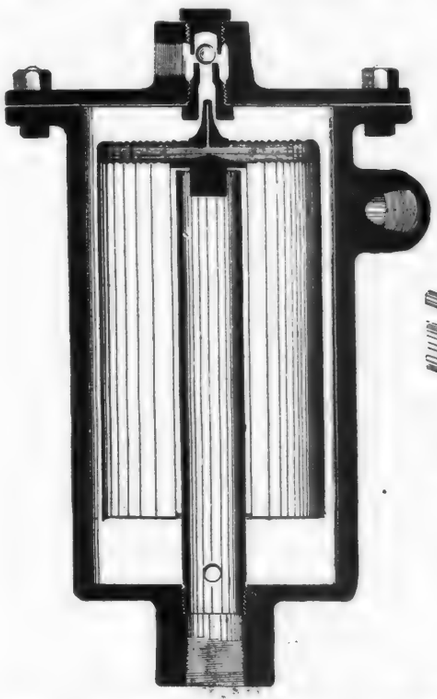


FIG. 1—HOLMBERG IMPROVED STEAM TRAP.

economically of 1000 sq. ft. of radiation.

Fig. 2 shows a typical piping diagram of a Holmberg system and indicates the method of connecting the return line to the boiler and the location of the trap. Fig. 3 shows the suggested method of installing the rap on he re-

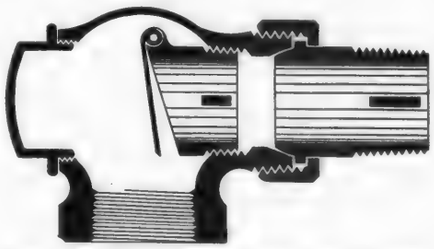


FIG. 4—HOLMBERG VACUUM SEAL RADIATOR RETURN VALVE.

turn riser with a swing check valve.

The Holmberg vacuum seal, shown in Fig. 4, is an automatic radiator return valve adapted to all kinds of two-pipe steam and vacuum vapor systems. Features of this device are the fact that it is self-cleaning, has no complicated parts to get out of order, and is adjustable to any desired position by simply turning the valve seat so that

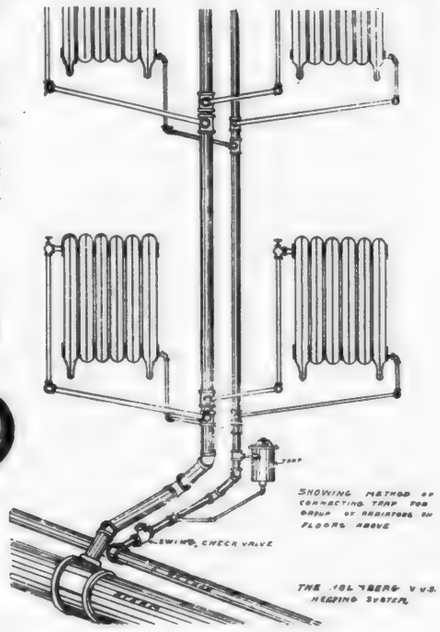


FIG. 3.

the check will hang perpendicular. The valve seat is removable without removing the valve itself.

The New "Phonograph" Heater

It looks like a phonograph. At first glance, you'd say it was a cabinet phonograph. Judging from appearances there is little to indicate that the Estate Heatrola, as this new apparatus is called, is in reality a warm-air house heater.

The entire exterior surface is enameled in a mahogany color and of unusual smoothness. It can be rubbed off or dusted with a cloth like any piece of furniture. Another point mentioned in its favor is that it does not obtrude itself in a room.

Estate Heatrola is in reality a pipeless warm-air furnace. It is designed to heat from three to six rooms, Equally good results may be secured, it is stated, by burning hard or soft coal, lignite or slack coal, or wood. It is guaranteed to hold fire 50 hours on one charge of any kind of coal. The heater may be installed wherever there is a flue connection. It has a reversible flue collar so that the smoke-pipe may be run directly into the wall, without extending above the heater.

Air is taken into the heater through louvre-type openings at both sides and in front of the heater and flows into the cast-iron chamber built inside the heater directly over the fire. It is discharged into the dome and flows into the room through the slotted open-

ESTATE "HEATROLA"

ings in all four sides of the dome.

Other features of this heater are its vapor tank of ½-gal. capacity, its jointless ash box with a capacity for a full 24-hour accumulation of ashes, a combination shaking and dumping grate, and a "hot blast" attachment in the form of an air control through a screw register in the front of the heater whereby superheated air may

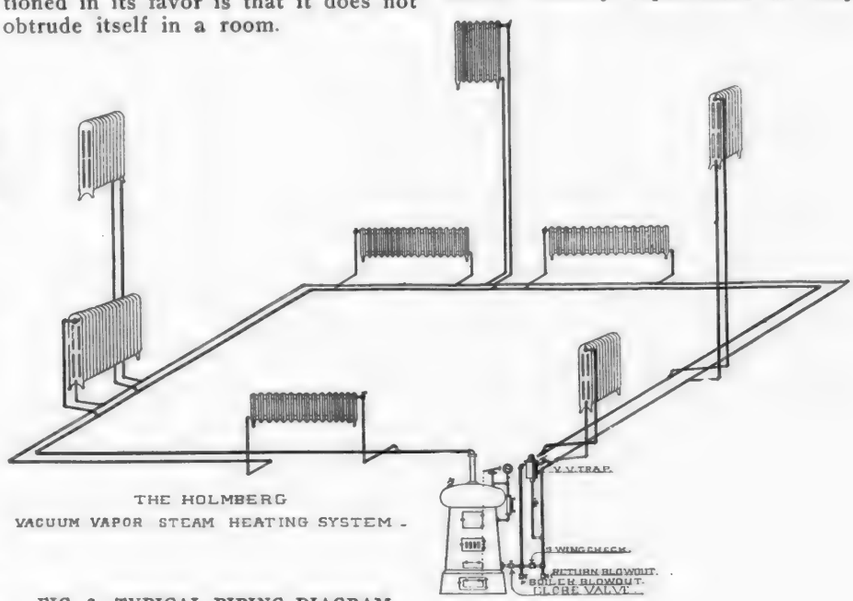


FIG. 2—TYPICAL PIPING DIAGRAM.

be carried to every part of the heater, preventing accumulation of dead ashes at the outer edge of the fire, besides securing better combustion generally. A smoke curtain attached to the upper door is designed to prevent smoke from pouring into the room when the feed door is opened.

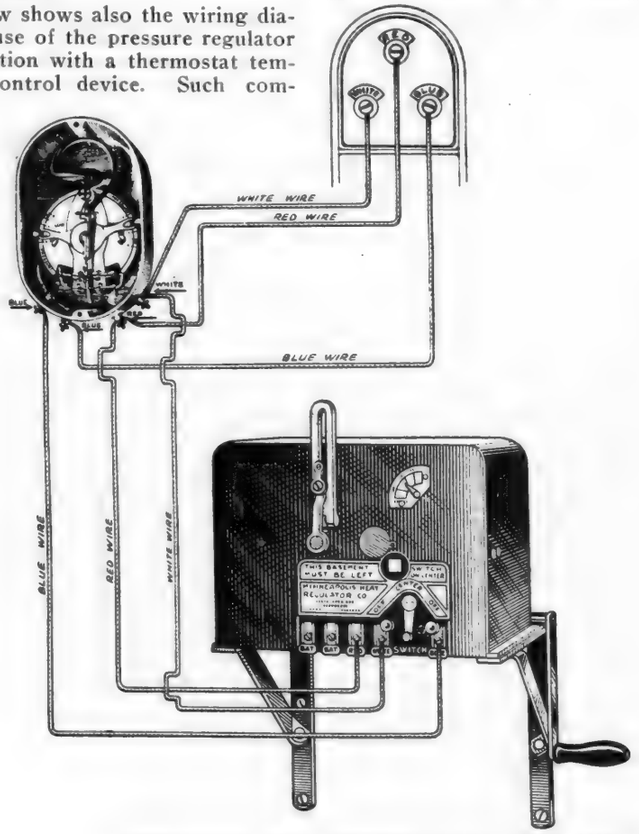
The dimensions of the heater are 49½-in. height over all, 23-in width over all, and 23-in. depth over all. Its net weight is 385 lbs.

The Estate Heatrola is manufactured by the Estate Stove Co., Hamilton, O.

Minneapolis Pressure Regulator

Designed specially for steam and vapor heating plants, the Minneapolis pressure regulator, made by the Minneapolis Heat Regulator Company, of Minneapolis, Minn., applies the fundamental principles of pressure gauge construction to the particular requirements of this service. Its structural features are shown in the accompanying illustration.

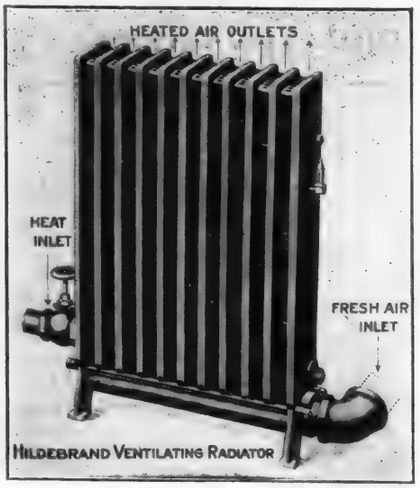
This view shows also the wiring diagram for use of the pressure regulator in conjunction with a thermostat temperature control device. Such combined regulation is recommended as providing a more even and reliable temperature than can be secured by thermostat control alone.



CONNECTIONS FOR PRESSURE REGULATOR AND THERMOSTAT COMBINED.

Hildebrand Ventilating Radiator

Wm. R. Hildebrand of Chicago has recently perfected a new ventilating radiator on which patent has been granted. This new radiator, the first working model of which has just been placed in operation, produces a constant air suction and air circulation by means of an adequate surface of contact whereby air is most readily and most efficiently heated. Connected with the outside, this new radiator sucks in fresh air, heats it to an agreeable temperature and distributes it freely throughout the room. It is thus adapted to take in fresh air continuously from out of doors and supplant the vitiated air of the living room, office or workshop without subjecting the occupants to cold draughts.



HILDEBRAND VENTILATING RADIATOR

The construction is very simple. There is an air inlet running parallel with the heat inlet and these two conduits carry and distribute heat and air. The radiator gets into action as soon as the steam is turned on; a touch of heat will start the air to circulate through the alternate air sections and the work of distributing warm air is well under way. Needless to say, the action is entirely automatic and the air suction, air blowing or air circulation is brought about by the "stack effect" of the heated air in the radiator.

Heating and ventilating are thus performed by one and the same apparatus, which heats the intake air by direct contact and the surrounding objects by radiation. At the present time, perhaps one living room in a thousand has positive ventilation because of the lack hitherto of a simple automatic means.

A New Form of Combustion Recorder.

To burn fuel with the greatest efficiency, it must be burned with just enough air to make complete combustion possible. Too much air unnecessarily increases the volume of flue gases which must be heated, and any excess in their volume increases the heat carried away by them accordingly. Too little air, on the other hand, results in incomplete combustion. Unburned combustible gases then escape up the chimney. Since they have a heating value often exceeding that of illuminating gas, it is clear that the heat losses due to incomplete combustion may be more serious than those due to too much air.

FIG. 1—DUPLEX MONO COMBUSTION RECORDER.

It is found in practice that to obtain the most economical results, a certain surplus of air is necessary above what would be theoretically correct. The amount of this surplus varies, depending on the many different factors that affect combustion. In any case, however, the point at which most economical combustion takes place is that point beyond which an increase in the air supply results in excessive volumes of flue gases, while reduction in the air supply results in incomplete combustion. This is the critical point.

Heretofore the control of combustion in boiler plants usually depended only on the recording of the percentages of CO_2 present in the products of combustion. While the recording of CO_2 indicates surplus of air in the flue gases, it does not indicate when incomplete combustion due to insufficient air is taking place.

The Duplex Mono recorder, shown in Fig. 1, is manufactured by the Mono Corporation of America, New York City, and has the special advantage over preceding types of flue-gas analysis recorders in that it records simultaneously not only the presence of excess air (inversely proportional to the CO_2 content of the flue gas), but also the condition of deficient air (as indicated by the presence of combustible gases CO, CH_4, and H_2 in the flue gas).

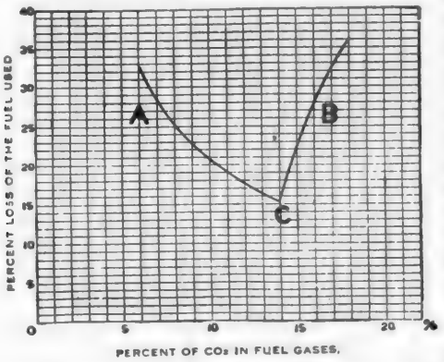


FIG. 2—RELATION BETWEEN FLUE LOSS AND PERCENT CO_2.

A glance at the curve in Fig. 2 will serve to explain the theory back of this recorder. As evident in this curve the percentage of fuel loss decreases with increase in percentage of CO_2 (which represents a decrease in the air supply). This effect obtains from point A to point C, but beyond this latter point a condition is reached where there is insufficient air supply to burn the combustible gases and from point C to point B there is a corresponding rise in per cent of fuel loss due to incomplete combustion. From this it is evident that the critical point of economical combustion is the point where incomplete combustion sets in with a decrease of air supply. It must always be borne in mind that it will vary with the load factor, fuel, thickness and uniformity of fire bed, distribution of air supply, draft, formation of clinkers, soot, etc. Only by simultaneously and continuously recording both excess air and combustible gases (CO_2 and $CO + CH_4 + H_2$) can this critical point be known at all times.

New Publications.

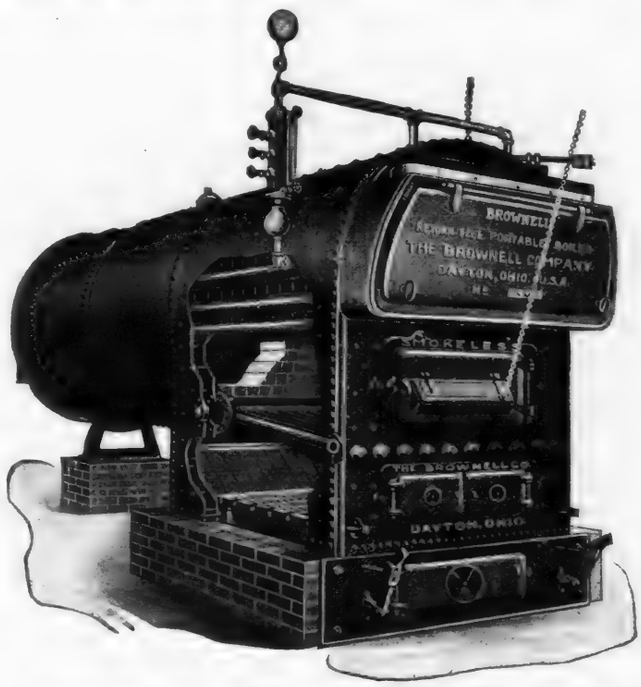
THE ANALYSIS OF SULPHUR FORMS IN COAL is the title of technical paper 254, written by Alfred R. Powell and issued by the United States Bureau of Mines. This paper describes and elaborates the method for the determination of the various forms of sulphur in coal as originally outlined by the author while working with Prof. S. W. Parr at the University of Illinois. The method, which at that time was found to be applicable to Illinois coals, is shown by the results of the present investigation to be accurate when applied to coals from widely different fields. Certain changes and optional methods of procedure are suggested which it is hoped will make the method conform better to routine and rapid commercial analysis Copies of technical paper 254 may be obtained by applying to the Director of the Bureau of Mines, Washington, D. C.

FINDING AND STOPPING WASTE IN MODERN BOILER ROOMS, in its second revised edition, has recently been issued by the H. S. B. W.—Cochrane Corporation, of Philadelphia, Pa. The treatment reminds of hand-book style, with possibly more explanatory text and less illustration and tabular matter. It covers such important phases of boiler room practice and theory as suggested by the section headings, fuels, combustion, heat absorption, boiler efficiency and boiler testing, and boiler plant proportioning. There is a good index at the back of the book and a modest amount of Cochrane advertising. The book is very well worth obtaining by any one directly or indirectly interested in boiler room economy. Size 4¾ x 7 in. Pp. 414. This is Publication No. 995, bound with flexible cloth covers, and is sold by the company for $1 per copy.

JOURNAL OF THE AMERICAN SOCIETY of Heating and Ventilating Engineers for April, contains the announcement that the society's Research Laboratory, in Pittsburgh, in the midst of its second fiscal year, has the following program of work in progress at the Pittsburgh laboratory: Infiltration, heat loss through building material, standardization of dust measurements, study of combustion in domestic heating boilers, checking application of heating boiler testing code, and temperature, humidity and air motion effects on health. At a number of university laboratories and elsewhere the investigations now under way include heat loss through building materials, radiant and convected heat, heat loss from pipes buried underground, study of pipe sizes, air friction in pipes as affected by density, chimney investigations, air infiltration, heat loss through glass and the comparative economy in heating by direct radiation and by air heated with steam coils. This issue of the Journal also contains a lengthy report with illustrations by C. M. Holland, chief engineer for the Hudson River tunnel commissions, dealing with the plans proposed for the ventilation of the New York-New Jersey Vehicular Tunnel. Under the title of "Licensing of Engineers," a summary is presented of the laws on this subject now in effect in Colorado, Florida, Idaho, Illinois, Iowa, Louisiana, Michigan, New York, Oregon, Virginia and Wyoming, as well as the general law proposed by the Engineering Council and the proposed law for Connecticut.

Trade Literature.

PORTABLE TYPE FIREBOX HEATING BOILERS of both the down-draft smokeless, and the direct draft varieties are described in Bulletin B-6A issued by the Brownell Company, Dayton, O. Along with the illustrations of these boilers there are given in the bulletin, tables of sizes and capacities for use in ordering the same. Size 8½ x 11 in. Pp. 8.



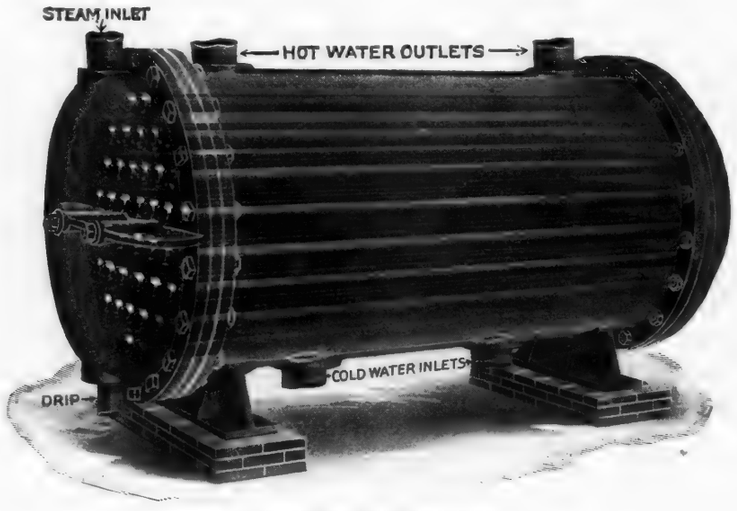
BROWNELL PORTABLE TYPE FIREBOX HEATING BOILER.

VALVE WORLD for February, 1921, the monthly periodical of Crane Co., Chicago, Ill., has an interesting item, with noteworthy illustrations, on Montgomery, Ward & Co.'s new Pacific northwest plant, in Portland, Ore. This issue also contains the suggestions of the National Fire Protection Association Committee

on Gases regarding "General Precautions in Gas-Piping Work."

ADSCO WATER HEATERS are described in Bulletin No. 152 of the American District Steam Co., North Tonawanda, N. Y. These are designed for heating buildings with water where the steam supply is from a central station heating system. The pamphlet shows not only a phantom view of the heater, but also a picture of piping connection for a typical installation. Size 6 x 9 in. Pp. 4.

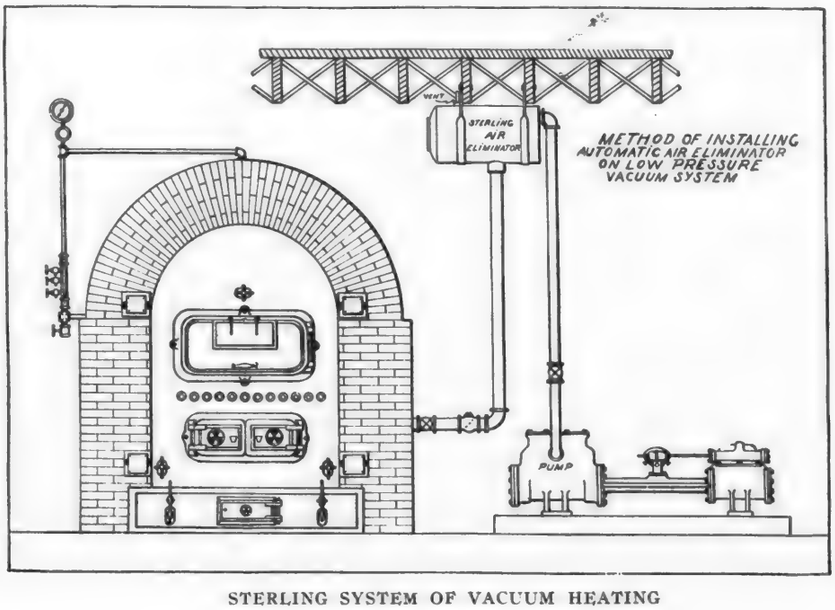
RECORDS OF PERFORMANCE TESTS on the Trane Thermetal traps are presented in Bulletin No. 6-A of the Trane Co., La Crosse, Wis. In the Trane research laboratory there is installed a standard radiator trap testing apparatus, a diagram of which is shown in this bulletin, together with the results of tests on a ½-in. trap. The back cover of this pamphlet carries a bird's-eye view of the Trane Company's plant and the typography throughout is distinctive. Size 6 x 9 in. Pp. 8, punched for binding.



ADSCO WATER HEATER.

STERLING SYSTEM OF VACUUM HEATING is analyzed in Bulletin No. 33 of the Sterling Engineering Co., Milwaukee, Wis., and a number of good points are found in connection with this system. Among these are the Sterling specialties consisting of the thermostatic trap, the graduated packless valve, the vacuum type air eliminator, the pump strainer, and the air line valve. Sample specifications for the use of architects are included in this pamphlet. Size 6 x 9in. Pp. 12, punched for binding.

HOFFMAN VENTING VALVES for every service are briefly illustrated in a recent folder issued by the Haynes Selling Co., Philadelphia, Pa. There are ten varieties of valve and an equalizing loop to divide the available space in this small folder, which they do in what seems to be a perfectly amicable way, with no pushing or crowding. By means of sectional views of these several devices it is possible to convey considerable information in relatively small space. Size 3½ x 6¼. Pp. 10.



STERLING SYSTEM OF VACUUM HEATING

Deaths

Albert P. Broomell, president of the Vapor Heating Co., York, Pa., and known as the "father of vapor heating," died at his home in that city, April 16, following an attack of peuritis, accompanied by grip. He was a little over 70 years old. Mr. Broomell was known as a successful manufacturer and inventor, with a striking personality that won him the loyalty of his associates to an unusual degree. It was in 1900 that he invented the Broomell system of vapor heating, the first installation being made that year in the Hotel Warwick, in Newport News, Va. In the same year a similar system was installed in the York Hospital, York, Pa. Both of these systems are still in successful operation. Mr. Broomell was also the inventor of the original Pullman automobile the first type of which had six wheels. He leaves a widow and two children.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE, published monthly at Cooperstown, N. Y., for April 1, 1921.

State of New York, County of New York, ss.

Before me, a notary public in and for the State aforesaid, personally appeared Arthur S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the Editor of THE HEATING AND VENTILATING MAGAZINE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443 Postal Laws and Regulations printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Editor, A. S. Armagnac, 1123 Broadway, New York, N. Y.

Managing Editor: None.

Business Manager: Gustave Petersen, 1123 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or if a Corporation, give its name and the name and address of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

A. S. Armagnac, 1123 Broadway, New York,

Gustave Petersen, 1123 Broadway, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain, not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stock holders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona-fide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 12th day of March, 1921.

LOUIS JACOB.

(My commission expires March 30, 1922.)

Notary Public, N. Y. County No. 72,

IDEAL

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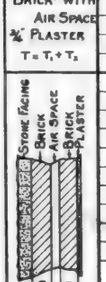
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

HEAT LOSS TABLES

WALLS

Brick with Air Space ½ Plaster $T = T_1 + T_2$



$T = T_1 + T_2$

Thickness $T = T_1 + T_2$	A Used by U of PA	B Reckhagel Reitschel	C Peglet (Carpenter)	D Austrian Government (Macon)	E Greene 1913	F Buffalo Forge Co	G Hubbard	H Thompson: 1 Wall Exposed, Furred and Plastered, Ho	2 Walls Exposed, Furred and Plastered, Ho	1 Wall Exposed 15% Added, Plastered on Brick, Ho	2 Walls Exposed 15% Added, Plastered on Brick, Ho	1 Wall Exposed 25% Added, Without Plaster, Ho	2 Walls Exposed 25% Added, Without Plaster, Ho	I Nat. Dist. Heat Assn	J Busey
4"	.36		.36												
8"	.27	.25	.30	.23		.27	.25	.340						.25	.23
12"	.22	.21	.25	.19	.27	.22	.21	.272	.220	.170	.253	.196	.264	.204	.22	.21
16"	.19	.19	.21	.17	.22	.19	.19	.221							.19	.19
18"	.17		.19						.175	.137	.201	.158	.201	.164		
20"	.16	.16	.18		.19	.17	.16	.187	.160	.125	.184	.144	.192	.150	.16	.16
24"	.15	.14	.17		.17	.15	.14	.170	.147	.115	.169	.132	.176	.138		
28"	.13	.13	.15		.15	.13		.153	.135	.105	.155	.121	.162	.126		
32"	.12	.12	.13		.13	.12			.117	.080	.139	.104	.140	.108		
36"	.12		.12		.12				.110	.084	.127	.097	.132	.101		
40"	.11	Air Space 2"	.10	Air Space 1"	.11				.100	.077	.115	.089	.120	.092		
30"	.13	4		Air Space 2"			No Plaster 85% of Plain Brick		.125	.097	.144	.112	.150	.116		

Thickness T	A Used by U of PA
8"	.25
12"	.20
16"	.17
20"	.15
24"	.14
28"	.12
32"	.12

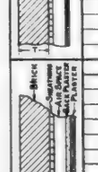
Given for brick or stone with air space. State whether plastered or not. Does not

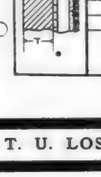
Plastered or not. Plastered on furring 2"

Assume wall thickness

Given as brick, hollow and plastered

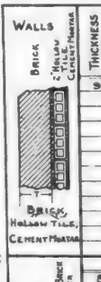
WALLS

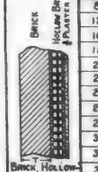




Thickness T	A Used by U of PA	B Reckhagel Reitschel	C Nat. Dist. Heat Assn	K H & V Magazine
12"	.45		—	.45
16"	.39		—	.39
20"	.35		—	.35
24"	.31		—	.31
28"	.28	—	—	.28
32"	.26	—	—	.26
		—	—	
	AA .17	—	AA .17	
		—	—	
		—	—	
		—	—	
		—	—	
	AAA .14		AAA .14	

WALLS



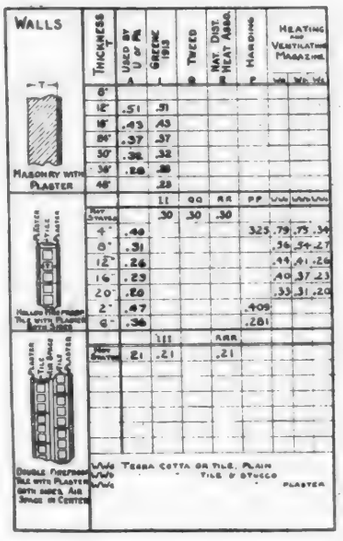


Thickness T	A Used by U or P	H Harding	I Greene 1913
9"	.30	.24	
			½" Hollow Tile, ½" Cement Mortar
	AA		E
8"	.29		.29
12	.24		.24
16"	.20		.20
18"			
20	.18		.18
21"			
24"	.16		.16
27"			
28"	.14		.14
30"			
32"	.13		.13
33"			
36"			
40"			

B. T. U. LOSSES—Jones Tables. No. 1-L.

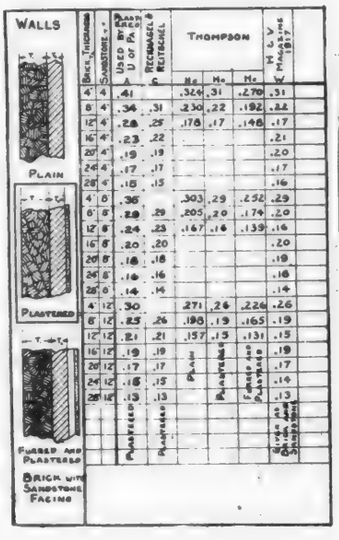
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

HEAT LOSS TABLES



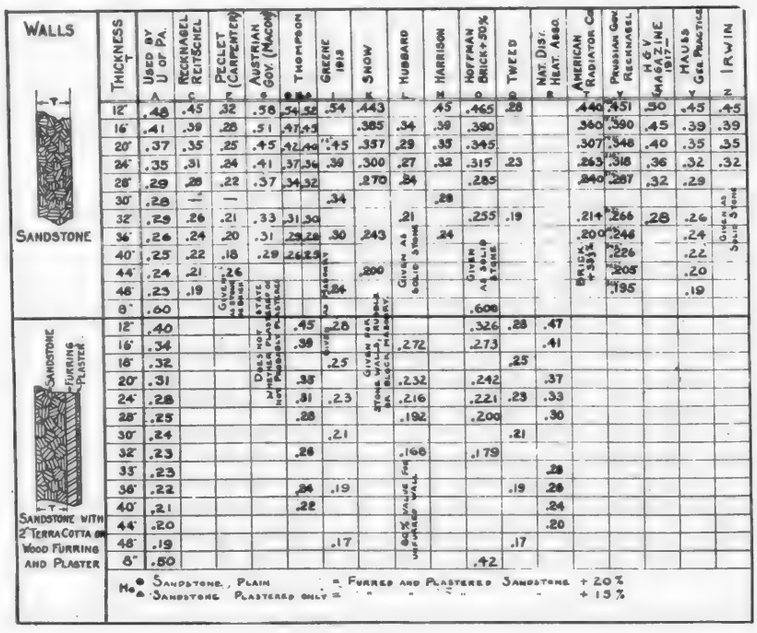
Thickness T	Used by U of Pa. A	Greene 1913 L	Tweed O	Nat. Dist. Heat Assn. P	Harding P	Heating and Ventilating Magazine Wa	Wb	Wc
8"								
12"	.51	.51						
16"	.43	.43						
20"	.37	.37						
30"	.32	.32						
36"	.28	.28						
48"		.22						
		11	00	AA	PP	WA	WB	WC
Not Stated		.30	.30	.30				
4"	.40				.325	.79	.75	.34
8"	.31					.36	.34	.27
12"	.26					.44	.41	.26
16"	.23					.40	.37	.23
20"	.20					.33	.31	.20
2"	.47				.409			
6"	.36				.281			
		111		AAA				
Not Stated	.21	.21		.21				

Wide Joints: Terra Cotta or Tile, Plain
Narrow Joints: Tile & Stucco
Wide Joints: Plaster



Brick, Thickness	Sandstone, T	Used by U of Pa. A	Rechnagel & Reitschel D	Thompson Me	Thompson Mo	Thompson Mc	H. & V. Magazine 1917 W
4	4	.41		.324	.31	.270	.31
8	4	.34	.31	.230	.22	.192	.22
12	4	.28	.25	.178	.17	.148	.17
16	4	.23	.22				.21
20	4	.19	.19				.20
24	4	.17	.17				.17
28	4	.15	.15				.16
4	8	.36		.303	.29	.252	.29
8	8	.28	.29	.205	.20	.174	.20
12	8	.24	.23	.167	.16	.139	.16
16	8	.20	.20				.20
20	8	.18	.18				.19
24	8	.16	.16				.18
28	8	.14	.14				.14
4	12	.30		.271	.24	.226	.26
8	12	.25	.26	.198	.19	.165	.19
12	12	.21	.21	.157	.15	.131	.15
16	12	.19	.19				.19
20	12	.17	.17				.17
24	12	.15	.15				.16
28	12	.13	.13				.13

Plain | Plastered | Furred and Plastered | Given as Solid Stone



Thickness T	Used by U of Pa. A	Reckhagel Reitschel C	Peclet (Carpenter) N	Austrian Gov. (Macomb) B	Thompson	Greene 1913 L	Snow P	Hubbard F	Harrison M	Hoffman Brick +30% D	Tweed O	Nat. Dist. Heat Assn. P	American Radiator Co.	Prussian Gov. Reichnagel K	H. & V. Magazine 1917	Haus & Gee Practice K	Irwin N
12"	.48	.45	.32	.58	.54 .52	.54	.443		.45	.465	.28		.440	.451	.50	.45	.45
16"	.41	.39	.28	.51	.47 .43		.385	.34	.39	.390			.360	.390	.45	.39	.39
20"	.37	.35	.25	.45	.42 .40	.45	.357	.29	.35	.345			.307	.348	.40	.35	.35
24"	.35	.31	.24	.41	.37 .36	.39	.300	.27	.32	.315	.23		.263	.318	.36	.32	.32
28"	.29	.28	.22	.37	.34 .32		.270	.24		.285			.240	.287	.32	.29	
30"	.28	—	—			.34			.28								Given as Solid Stone
32"	.29	.26	.21	.33	.31 .30			.21		.255	.19		.214	.266	.28	.26	
36"	.26	.24	.20	.31	.29 .28	.30	.243	Given as Solid Stone	.24				.200	.246		.24	
40"	.25	.22	.18	.29	.26 .25	Masonry			Given as Solid Stone				Brick +30%	.226		.22	
44"	.24	.21	Given as Stone Masonry				.200							.205		.20	
46"	.23	.19	Given as Stone Masonry			.24								.195		.19	
8"	.60									.608							
12"	.40				.45	.28				.326	.28	.47					
16"	.34				.38	Given as Solid Stone		.272		.273		.41					
18"	.32					.25					.25						
20"	.31				.35			.232		.242		.37					
24"	.28				.31	.23		.216		.221	.23	.33					
28"	.25				.28			.192		.200		.30					
30"	.24					.21					.21						
32"	.23				.26			.168		.179							
33"	.23											.28					
36"	.22				.24	.19					.19	.26					
40"	.21				.22							.24					
44"	.20											.20					
48"	.19					.17					.17						
8"	.50									.42							

Sandstone, Plain = Furred and Plastered Sandstone + 20%
Sandstone Plastered only = " " " " + 15%

Back Wall Unfurred

B. T. U. LOSSES—Jones Tables (Continued). No. 1-M.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

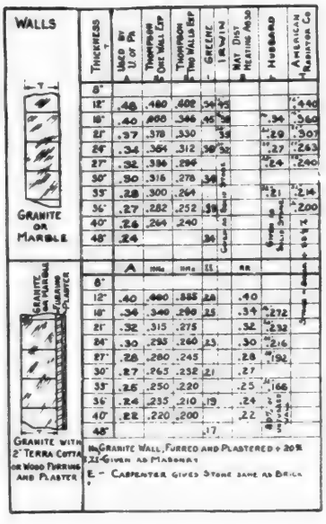
HEAT LOSS TABLES

WALLS

Thickness T	Used by U. of Pa. A	Austrian Gov. (Hagon) B	Reichsangel Reitschel. C	Peclet (Carpenter) F	Pressure Gas (Reichsangel) K	Greene 1913 F	Snow (Sandstone) H	Hubbard F	Hoffman Brick + 30% D	Nat. Dist. Heat Assn. P	American Radiator Co. Brick + 35% K	Magazine 1917	Thompson ● No	Thompson ▲ No	Haus Gen. Plastic. Y	Irwin N	
8"	.63								.600								
12"	.51	.64	.49	.32	.496	.54	.487		.465		.440	.49	.538	.564	.495	.45	
16"	.43	.56	.43	.28	.429		.424	.34	.390		.360	.46	.516	.495	.429	.39	
18"	.41			.26		.45											
20"	.39	.50	.38	.25	.383		.393	.29	.345		.307	.41	.456	.437	.385	.35	
24"	.35	.45	.35	.24	.350	.39	.330	.27	.315		.265	.37	.420	.403	.352	.32	
28"	.31	.41	.31	.22	.316		.299	.24	.286		.240	.33	.372	.357	.319		
30"	.30					.34											
32"	.29	.36	.28	.21	.293			.21	.255		.214	.29	.336	.322	.286		
36"	.26	.34	.26	.20	.271	.30	.267				.200		.318	.299	.264		
40"	.27	.32	.24	.18	.249								.298	.276	.242		
44"	.26		.23		.225		.220								.220		
48"	.25		.21		.214	.24									.209		

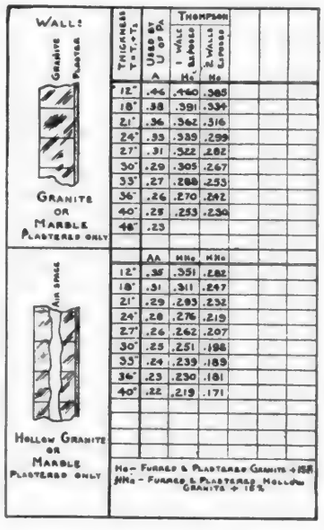
12"	.43					.28			.326	.52			.49				
16"	.36							.272	.273	.46			.43				
18"	.34					.25											
20"	.32							.232	.242	.41			.36				
24"	.29					.23		.216	.221	.38			.35				
28"	.27							.192	.200	.34			.31				
30"	.25					.21											
32"	.24							.168	.179	.32			.28				
36"	.23					.19				.29			.26				
40"	.23									.26			.24				
44"	.22									.23							
48"	.21					.17											

Ho ● Limestone, Plain = Furred and Plastered Limestone + 20%.
Ho ▲ Limestone, Plastered only = " " " " + 15%.


WALLS
T
GRANITE OR MARBLE
GRANITE OR MARBLE WITH AIR SPACE AND PLASTER
GRANITE WITH 2" TERRA COTTA OR WOOD FURRING AND PLASTER
Ho Granite Wall, Furred and Plastered + 20%
.22-Given as Masonry
E - Carpenter Gives Stone same as Brick

Thickness T	Used by U of Pa. A	Thompson One Wall Exp	Thompson Two Walls Exp	Greene Irwin	Nat. Dist. Heating Assn	Hubbard F	American Radiator Co.
8"							
12"	.48	.480	.402	.34			.440
16"	.40	.400	.346	.30		.34	.360
20"	.37	.378	.330		.33	.29	.307
24"	.34	.364	.312	.30	.32	.27	.283
27"	.32	.336	.296			.24	.240
30"	.30	.316	.278	.26			
33"	.28	.300	.264			.21	.214
36"	.27	.282	.252	.24			.200
40"	.26	.264	.240				
48"	.24			.20			

	A	Ho	Hho	E	BB		
8"							
12"	.40	.480	.385	.28	.40		
16"	.34	.340	.298	.25	.34	.272	
20"	.32	.315	.275		.32	.232	
24"	.30	.295	.260	.23	.30	.216	
27"	.28	.280	.245		.28	.192	
30"	.27	.265	.232	.21	.27		
33"	.25	.250	.220		.25	.166	
36"	.24	.235	.210	.19	.24		
40"	.22	.220	.200		.22		
48"				.17			



Thickness T+T1	Used by U of Pa. A	Thompson 1 Wall Express Ho	Thompson 2 Walls Exposed Ho
12"	.46	.440	.385
18"	.38	.381	.334
21"	.36	.362	.316
24"	.33	.339	.299
27"	.31	.322	.282
30"	.29	.305	.267
33"	.27	.288	.253
36"	.26	.270	.242
40"	.25	.253	.230
48"	.23		

	AA	HHo	HHo
12"	.36	.351	.282
18"	.31	.311	.247
21"	.29	.293	.232
24"	.28	.276	.219
27"	.26	.262	.207
30"	.25	.251	.198
33"	.24	.239	.189
36"	.23	.230	.181
40"	.22	.219	.171

Ho - Furred & Plastered Granite + 15%
HHo - Furred & Plastered Hollow Granite + 15%

B. T. U. LOSSES—Jones Tables (Continued). No. 1-N.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

HEAT LOSS TABLES

WALLS	THICKNESS T. T.' T."	Used by U. of Pa. A	Thompson One Wall Ex B	Thompson Two Walls Ex C	Mat Dist Heat Assn D	Hubbard F	Pellet (Lafayette) G
Hollow Granite or Marble T + T' + T"	8"						.30
	12"	.37	.366	.294			.25
	16"	.33	.324	.258		.289	.19
	20"	.31	.306	.242		.244	.18
	24"	.28	.288	.228		.229	.17
	27"	.28	.274	.216		.209	.15
	30"	.26	.262	.206		.179	
	33"	.25	.256	.197			.13
	36"	.24	.240	.188			.12
	40"	.23	.228	.178			.10
							.21
Hollow Granite or Marble with 2" Terra Cotta or Wood Furring and Plaster T + T' + T"	8"	A					
	12"	.30	.305	.245	.30		
	16"	.25	.270	.215	.21	.231	
	20"	.23	.253	.202	.20	.197	
	24"	.22	.240	.190	.19	.184	
	27"	.21	.228	.180	.18	.163	
	30"	.20	.218	.172	.17	.143	
	33"	.19	.208	.164	.16		
	36"	.18	.230	.157	.16		
	40"	.17	.190	.149	.15		
		H=Hollow Granite, Furred and Plastered +20%					
		Or Marble, " " " +20%					

WALLS	THICKNESS T. T.' T."	Used by U. of Pa. A	Thompson B	Greene J	Busey K	Mat Dist Heat Assn D	Austrian Gov. (Macon)	Hubbard F	Buffalo Forge
Concrete with 2" Terra Cotta or Wood Furring and Plaster T + T' + T"	8"	.63						.528	.276
	12"	.48	.45	.26	.34	.47		.384	.240
	16"	.34	.39			.41		.312	
	18"	.31		.24	.28				.216
	20"	.29	.35		.26	.37		.264	.192
	24"	.26	.31	.21		.33			
	28"	.24	.28			.30			
	30"	.23		.19					
	32"	.22	.26						
	33"	.22				.28			
	36"	.20	.24	.17		.26			
	40	.18	.22			.24			
	44	.17				.20			
	48"	.16		.13					
	4"	.72							.336
Double Concrete Wall with Air Space T + T' + T"	8"	.48					.30	.561	.300
	12"	.37					.28	.408	.252
	16"	.33					.26	.331	.228
	20"	.29					.24		.192
	24"	.26					.22		
	28"	.24					.20		.168
	32"	.22					.19		
	36"	.20					.18		
	40"	.18					.17		

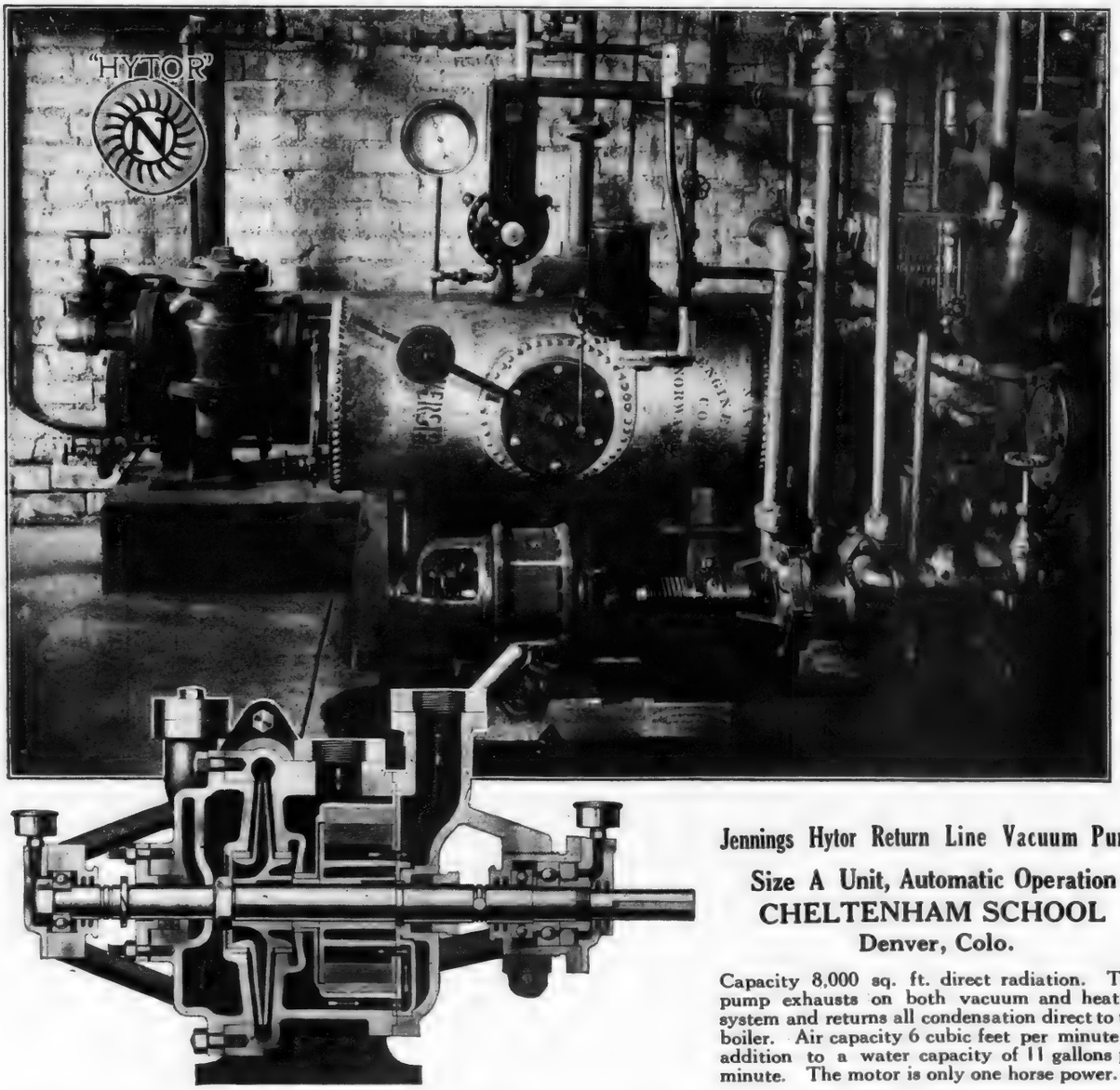
WALLS	THICKNESS T	Used by U. of Pa. A	Austrian Gov. (Macon) C	Thompson Hn	Thompson Hs	Buffalo Forge Co L Brick + 20%	Hubbard F	Harrison E		American Rad. Co Brick + 50% I	H & V Magazine 1917 K	Greene M	Donnelly M	Irwin Z	Busey C			
Plain Concrete	2"			.87*										.85				
	4"	.90		.69*		.624		.56		1.020	1.07		1.07	.785				
	6"	.77		.59*							0.70		.714	.56				
	8"	.63	.49	.49		.444	.66	.41		.690	0.51		.527	.49	.463			
	10"	.56		.44*										.42				
	12"	.48	.43	.54*	.540	.348	.48	.31		.495	0.43	.48	.357	.37	.363			
	16"	.41	.37	.37	.468		.39			.405	0.36		.257		.313			
	18"	.38				.300						.38						
	20"	.35	.33	.33	.420	.264				.345					.275			
	24"	.31	.30	.30	.372					.300		.31			.257			
	28"	.28	.27	.27	.336	.228				.270					Brick + 25%			
	30"	.27										.27						
	32"	.26	.25	.25	.312					.240								
	36"	.24	.23	.23	.288					.225		.24						
	40"	.22	.22		.264							.19						
Concrete Plastered One Side		AA			HHo	JJ				Cinder Concrete 1:2:4	WW			UU				
	4"	.82				.600												
	8"	.59				.432									.450			
	12"	.46			.518	.336						.45			.350			
	16"	.39			.443	.288						.39			.300			
	20"	.33			.403	.252						.35			.263			
	24"	.29			.357							.31						
	28"	.27			.322	.216						.28						
	32"	.25			.299							.26						
	36"	.23			.276													
	40"	.21			.253													

Does not state whether plastered or not. Probably plastered.

Hs — Furred and Plastered Concrete +20%
HHo — " " " " +15%
Hm { Ascribed by Macon to Reitschel and for ordinary construction have been increased 25% (Above figures have been increased)

B. T. U. LOSSES—Jones Tables (Continued). No. 1-O.

EFFICIENT HEATING *demands the* JENNINGS PUMP



Jennings Hytor Return Line Vacuum Pump

Size A Unit, Automatic Operation

CHELTENHAM SCHOOL

Denver, Colo.

Capacity 8,000 sq. ft. direct radiation. This pump exhausts on both vacuum and heating system and returns all condensation direct to the boiler. Air capacity 6 cubic feet per minute in addition to a water capacity of 11 gallons per minute. The motor is only one horse power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. The one moving element revolves without contact.

There are many other reasons why the Jennings is being installed on practically all of the big jobs. Bulletin No. 8 gives them in detail. Write for it.

NASH ENGINEERING COMPANY

SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

May 23-26, 1921—Spring meeting of American Society of Mechanical Engineers, in Chicago, Ill.

May 30-June 2, 1921—Thirty-second annual convention of the Heating and Piping Contractors' National Association, in Boston, Mass. Headquarters at the Hotel Brunwsick, Copley Square.

June 14-17, 1921—Semi-annual meeting of the American Society of Heating and Ventilating Engineers in Cleveland, O. Headquarters at the Hotel Winton.

June 22-24, 1921—Twelfth annual convention of the National District Heating Association, at Cedar Point, O. Headquarters at "The Breakers."

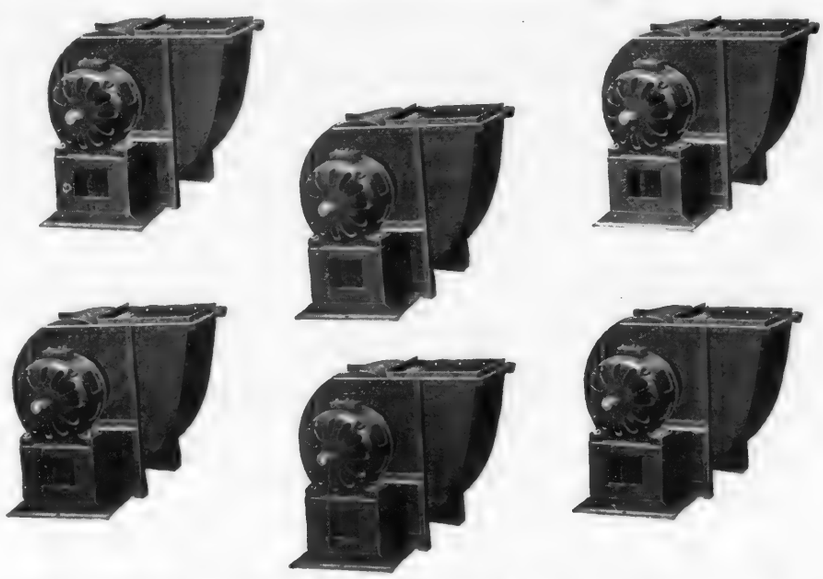
Miscellaneous Notes.

Chicago, Ill.—Plans are under way, according to President Charles J. Lehn of the Chief Engineers' Association of Chicago, for establishing block unit heating and lighting plants in the "loop" district of Chicago, with a view of establishing a "smokeless loop." Such units, it is stated, are in existence in several blocks and have been found practical and economical. It is planned to equip all of the plants with the latest smoke-consuming devices.

Eastern Supply Association will hold its regular summer meeting in Washington, D. C., June 8, at the New Willard Hotel.

Building operations in March as compiled by the F. W. Dodge Company, indicate progress toward resumption of normal activity. Contracts awarded during March in the 25 northeastern States amounted to $164,194,000, an increase of 63% over the February figure. The increase is largely due to a greatly increased number of small projects. The total number of contracts awarded in March was 78% greater than in the preceding month. A comparison of this year's activity with that of last year, it is maintained, is not to the point. At this time last year building activity was approaching the crest of a wave, while now it is emerging from the trough. The conditions of this year, it is claimed, are more nearly like those of 1919. Contracts awarded during the first quarter of this year have numbered 12,180 and have amounted to $376,631,000. During the first quarter of 1919, contracts numbered 10,724, amounting to $274,562,000. Residential projects took the lead in March, being 37% of the total. Public work and utilities came to 21%, business buildings to 14%, educational buildings to 11% and industrial buildings to 7% of the total. The increase in operations was general throughout the entire section, New England reporting an increase of 84%, New York State and northern New Jersey, 40%; middle Atlantic States, 65%; Pittsburgh district, 87%; central west, 49%; and northwest, 152%.

Present prices for heating and plumbing materials represent a reduction of from 25% to 50% from those prevailing during part of 1919 and 1920, according to F. D. Keeler, general manager of the Rockford Brass Works, Rockford, Ill. "The consumer or prospective builder," he adds, "will have to pay at this time less than two-thirds of the average prices prevailing during 1919 and 1920 for the



An installation consisting of six B.-T. Uniblade Motor Driven Blowers in the American Sheet & Tin Plate Company's plant.

Uniblade Blowers

are manufactured for engine, also pulley and motor drive. These blowers are especially adaptable on installations where quietness is essential. Motor driven units are easily installed, due to the fan and motor being self-contained as one unit.

These units can be furnished up to and including 100-inch size.

Write for catalog and discounts

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BATTERMAN-TRUITT COMPANY

General Offices and Works: **730-38 W. Monroe St., Chicago, Ill.**

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Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

heating and plumbing materials required."

New York—Opening of several new schools in Brooklyn has been delayed by the failure to fulfill sub-contracts, some of them involving the installation of heating and plumbing equipments. The opening of Public School 29 is delayed by the non-release of the contracts for heating and ventilating which have been suspended by the city, pending an investigation of contractors' affiliations with the "Hettrick code." This statement was made in the semi-annual report of Superintendent of School Buildings C. B. J. Snyder. Mr. Snyder pointed out that the building of new schools had practically ceased early in October, but that gradually all work was resumed except some of the heating and plumbing contracts, the validity of which was questioned. The report stated that the Board of Education had declined to cancel the heating and ventilating contracts of P. S. 20, 29 and 182, in Brooklyn, although requested to do so by the Board of Estimate. This stand was taken, said Mr. Snyder, because the Board of Education did not believe that the evidence warranted such action.

New York—Recent interesting developments in the building situation in New York include the prediction of P. H. Woodward, general passenger agent of the Long Island Railroad, that Long Island will experience the greatest building boom in its history in 1921. According to an announcement of the Builders' Association of Manhattan, the association is preparing to build thousands of house-keeping apartments for three or four rooms each in Greater New York, to rent for $50.00 to $60.00 per month. The one factor which is causing hesitation is money. As matters are at present mortgage money has to compete with tax-exempt securities of all sorts. In this connection it is announced by Dr. Royal S. Copeland, health commissioner of New York, that a plan has been evolved whereby home builders

The Air You Breathe Should be as Pure as the Water You Drink

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Self Cooled Motor Propeller Fans

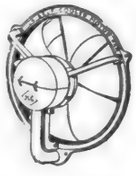
AND

Universal Blowers

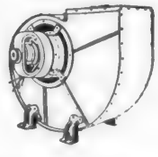
are extensively used for ventilating Restaurants, Stores, Hotels, Halls, Theatres, Residence Kitchens, Garages, Schools, Public Buildings, etc.

The summer season brings with it many urgent needs for correct ventilation.

Contractors and dealers should get their orders in early for prompt shipments.



ILG ELECTRIC VENTILATING CO.
2858 N. Crawford Avenue
CHICAGO, ILLINOIS
BRANCHES IN ALL LARGE CITIES



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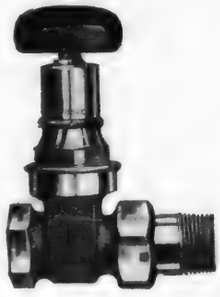
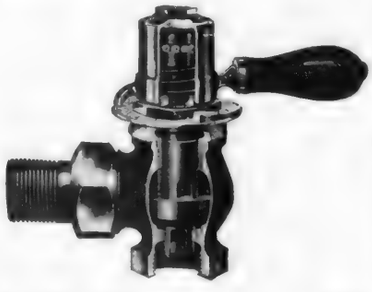
Dole



WE elected years ago to be the builders of the best radiator valves on the market. We have succeeded in our ambition. If any man desires to study the radiator valve field—he will become convinced of the fact that Dole Radiator Valves dominate their market.

A VALVE FOR EVERY SYSTEM

Write for catalogue and discounts

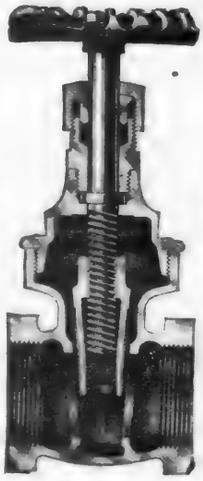


DOLE VALVE CO., Chicago, Ill.
1933 Corroll St.

REG. U.S. PAT. OFF.
TRADE JENKINS MARK
Jenkins Bros

Jenkins Brass Gate Valves
(Standard Pattern)

Fig. 370 is designed for 125 pounds working steam pressure or 175 pounds working water pressure, and can be repacked when wide open under pressure. Equipped with non-heat hand wheels; or can be furnished with brass wheels, finished or plated, or special finish according to requirements.



Sectional view of Figure 370

Fig. 370

Sold at supply houses everywhere. Look for the Diamond Mark on the body.

JENKINS BROS.
New York Philadelphia Chicago Boston
Montreal London Havana
FACTORIES: Bridgeport, Conn.; Elizabeth, N. J.; Montreal, Can. 2268-J

Jenkins Valves
SINCE 1864

This strong, hollow, copper ball is the whole "works" of a Johns-Manville Radiator Trap.

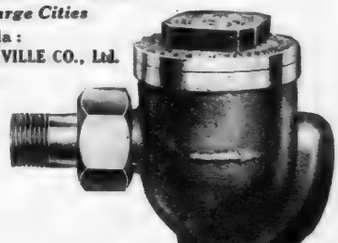
It can't help working right

THE Johns-Manville Radiator Trap, because of the simplicity of its construction and the continuous, faithful manner in which it discharges water and air, is a profitable trap to install. There are no adjustments to make—your payments will not be held up because a trap fails to work—it can't help working right.

The Johns-Manville Radiator Trap
How it works

The hollow, copper ball floats inside the trap, held against and closing the discharge orifice by unbalanced pressure. When water enters the trap, the ball rolls up, uncovering the discharge orifice through which the water and air flow out of the trap. When the water level is lowered the ball rolls over and closes the discharge orifice preventing the loss of steam.

JOHNS-MANVILLE
INCORPORATED
Madison Ave., at 41st St., New York City
Branches in 63 Large Cities
For Canada:
CANADIAN JOHNS-MANVILLE CO., Ltd.
Toronto



Through—
Asbestos
and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE Radiator Trap

will be able to place a large part of the values of their homes on mortgage. Certain amendments to the State banking laws are being advocated which would permit 75% to 80% of the value of any property to be utilized for building purposes, while the same percentage of value of the buildings would be available in loans from life insurance companies and building and loan associations. It was stated that the Metropolitan Life Insurance Company has already offered to loan $10,000,000 for building purposes on that basis.

Chicago, Ill.—In connection with the Federal grand jury investigation of building conditions in Chicago, evidence has been brought out on the subject of the exclusion of "foreign made" heating plants from local bungalows and houses. The exclusion, it is charged, adds materially to the cost of erecting small homes, as well as larger construction projects. It is alleged that a combination exists between the local master steam fitters' association and the steam fitters' union which bars the installation of certain types of steam and water heating boilers for bungalows, restricting the local market to certain "preferred" makes which sell at a higher price. The investigation is part of a federal drive into the alleged combines which are said to exist in the heating, plumbing and sheet metal sections of the building industry. In addition to the federal investigation, the State legislature has appointed a commission, which is known as the Dailey commission, to probe building conditions. More than 100 subpoenas have already been issued covering every angle of building work. The evidence obtained so far, it is stated, is shaping itself into three broad channels. One covers individual extortions and "shakedowns" on buildings by labor leaders, and the collection of minor forms of graft. A second deals with cases where alleged criminal combinations bar the use of outside materials by local construction projects in restraint of trade. The third deals with combinations and price-fixing rings between contractors, sub-contractors and local labor leaders. Every effort, it is announced, will be made to have the commission made a permanent institution, as the evidence already obtained is so great that the members feel it will be impossible to handle it properly before the legislature adjourns in June.

Dwight P. Robinson & Co., Inc., New York, has appointed Victor T. Goggin as one of the company's contracting engineers. Mr. Goggin was previously New England sales manager of Fred T. Ley & Co., Inc., of Springfield, Boston and New York.

National Foreign Trade Council will hold its eighth annual convention in Cleveland, May 4-7. Paramount questions which will be up for discussion include revision of the tariff, financing our foreign trade, the merchant marine and the double taxation of investments made abroad by Americans in the interest of foreign trade extension.

Illinois Society of Architects is authority for the accompanying information on the changes in costs of the different items of a building in which comparison is made of two sets of estimates that were submitted by contractors on the same building, one last year and one since January 15, this year:

Cost of building, 1920 and 1921.

Project No. 1: An 18-Apartment Building

	May 20, 1920	Jan. 10, 1921	Per cent change
Masonry	$44,300	$40,220	— 9.2
Carpentry	74,000	55,700	—24.7
Concrete	5,200	4,650	—10.6
Stone	5,578	6,200	+11.3
Plumbing	28.100	25 870	— 7.9
Heating	11,250	10.600	— 5.8
Electri:	4.525	4,300	— 5.0
Plastering	22,200	17,400	—21.6
Steel	4,629	4.109	—11.3
She·t Metal	2,890	2 960	+ 2 3
Painting	14.920	12,300	—17.5
Glass	2 113	2 200	+ 4.1
Tile	5,843	5,700	— 2.4
Total	$225,548	$192,209	—14.8

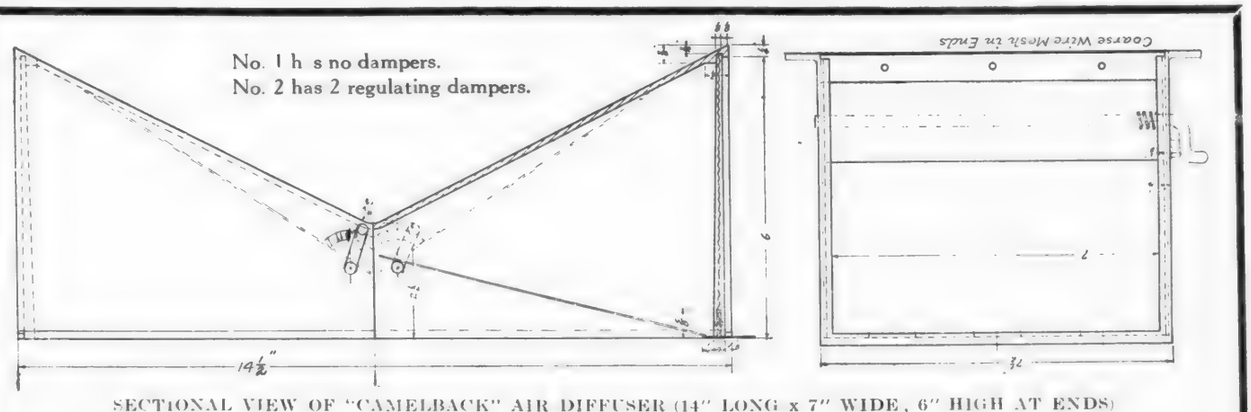
Project No. 2: Small Manufacturing Plant

	July 19, 1920	Jan. 19, 1921	Per cent decrease
Total	$605,348	$551,282	— 8.9

Project No. 3: A High Grade Residence

	Jan. & Feb, 1920	Jan. & Feb. 1921	
Total	$65,139	$63,164	— 3.0

Material and labor for each branch of the work of project number two,



SECTIONAL VIEW OF "CAMELBACK" AIR DIFFUSER (14" LONG x 7" WIDE, 6" HIGH AT ENDS)

Distribution of Fresh Air in Theatre, School and Church Auditoriums by the Use of "Camelback" Air Diffuser

Will appeal to every Architect, Heating and Ventilating Engineer and Contractor.

Less duct work required, saving a great expense in masonry.

Maximum quantity of air delivered (84 sq. in.) with minimum number of diffusers.

Friction loss negligible.

Admits of the use of the *lowest slung* chair seat.

Made of cast iron—no parts removable. It is fool proof. A new and proven device.

Blue Prints and Prices on Request

Knowles Mushroom Ventilator Co., 9 Church Street, New York

Increased Production

Up-to-the-minute concerns know that comfort of their employees is the first essential to good production.

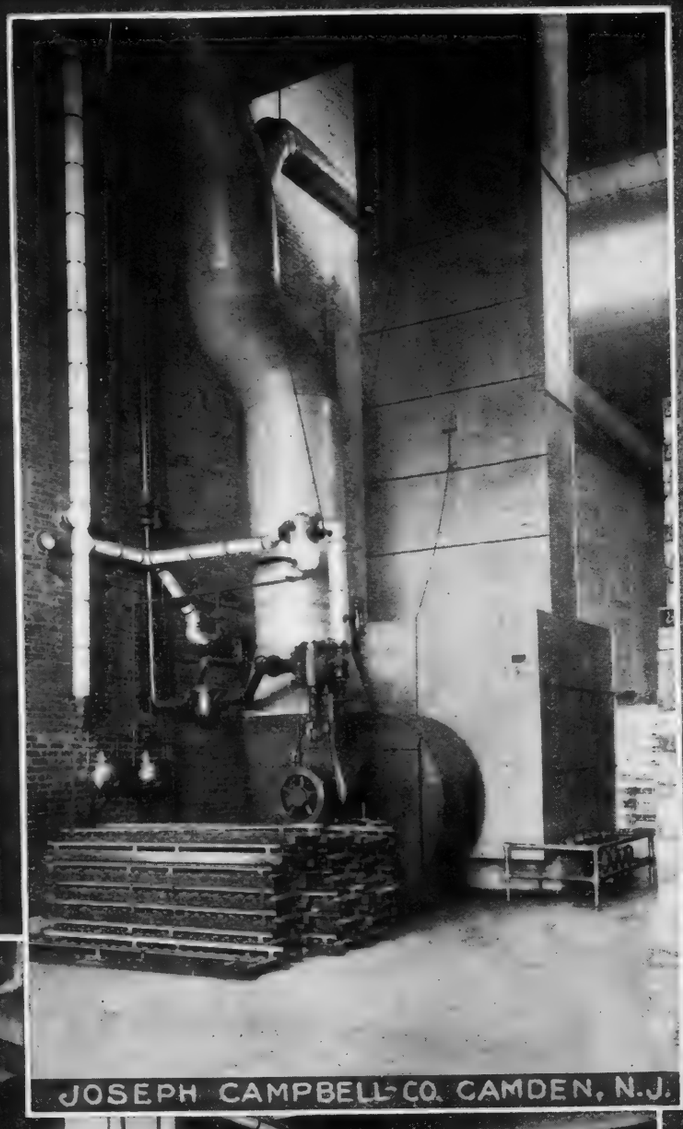
Buffalo Heating & Ventilating apparatus is installed in hundreds of manufacturing concerns.

Catalog 700-36 gives complete engineering data.

Write for your copy.

Buffalo Forge Co.
BUFFALO, N. Y.

"Buffalo"



JOSEPH CAMPBELL CO. CAMDEN, N.J.

BEECH NUT PACKING CO. CANAJOHARIE, N.Y.

are given in percentages of the total cost of the structure in the following table:

Items	Materials		Labor	
	Cost	P.ct. of total cost	Cost	P.ct. of total cost
Concrete Masonry	$56,254	10.20	$43,986	7.90
Brick Masonry	41,150	7.48	32,130	5.84
Carpenter Work	53,354	9.70	22,866	4.15
Radial Brick Chimney	3,566	0.65	2,304	0.41
Water Tube Boilers	9,387	1.70	4,836	0.88
Struc. Steel and Misc. Iron	13,440	2.45	12,300	2.23
Steel Sash	20,585	3.77	3,984	0.72
Fire Doors, etc.	2,960	0.53	3,350	0.61
Glazing	13,525	2.42	8,456	1.53
Plastering	3,471	0.63	4,243	0.76
Roofing	12,090	2.20	4,310	0.78
Painting	3,265	0.59	9,396	1.71
Heating	47,700	8.67	13,300	2.42
Electric Wiring	15,150	2.74	5,856	1.07
Sprinklers	19,675	3.57	12,440	2.26
Gravity Tank	4,847	0.88	1,450	0.26
Plumbing and Drainage	13,112	2.38	6,164	1.12
Miscellaneous	15,484	2.83	10,894	1.96
Total	$349,015	63.39	202,265	36.61

Phoenix Association, No. 24, N. A. S. E. of New York, is giving an illustrated lecture on "Prevention of Corrosion in Iron and Steel Pipe," by A. B. Christen, of the Anti-Corrosion Engineering Company, assisted by N. C. Nicol, of the National Tube Company.

Cleveland, O.—President Walter Klie of the Heating and Piping Contractors' Cleveland Association has been elected president of the National Association of Building Trades Employers. Mr. Klie was formerly president of the Building Trades Employers' Association of Cleveland. He is a member of the Committee on Trade Relations of the Heating and Piping Contractors' National Association.

Heating and Piping Contractors' New York City Association elected the following officers at its recent annual meeting: President, Charles Schneider; vice-president, Charles G. Witherspoon; treasurer, John T. Dyas. Directors: above-named officers and William D. Emery and George M. Scott.

Coon-DeVisser Co., contracting sales engineers, Detroit, Mich., announce the removal of its offices to 1772 West Lafayette Boulevard. As during the past 11 years and more, the firm will continue to handle mechanical equipment, including Taylor stokers, Ball engines, Ashton valves, Buffalo fans and pumps, Carrier air washers, cooling towers, Hoppes heaters and meters, Illinois vacuum heating systems and steam specialties, Kewanee boilers, Patterson-Kelley closed heaters, Tycos recording thermometers, etc. In addition the company has opened a supply department which will be stocked with a supply of Jenkins valves, Jenarco packings and Illinois steam specialties. The firm has also organized a Taylor stoker service station which will supply parts for the State of Michigan and all territory west of Detroit. The officers are: President, Thurlow E. Coon; vice-president and treasurer, J. H. DeVisser; vice-president and manager of engine, pump and heater department, H. P. Wilder; vice-president and manager of heating and ventilating department, H. H. Hughson; vice-president and manager of fuel-saving apparatus department, A. W. Conklin; secretary and assistant treasurer and manager of supply department, F. H. Field.

E. R. Little Co., Inc., designing and consulting engineers, Detroit, Mich., announces the removal of its offices to 1918-1920 Ford Building.

Engineering Business Exchange, New York, announces the opening of a southeastern branch in the McLachlen Building, Washington, D. C., with Marshall I. Leighton, consulting engineer, as director. During the past three years Mr. Leighton has acted as chairman of the National Service Committee of the Engineering Council and has taken a prominent part in advocating the establishment of a Federal Department of Public Works. He is a graduate of the Massachusetts Institute of Technology. Associated with Mr. Leighton will be A. C. Oliphant, who was also active in the work of the Engineering Council.

Bureau of Mines announces that two new educational motion picture films are ready for distribution. One film, entitled "A Dollar Saved is a Dollar Earned," was produced in co-operation with the National Association of Pipe Covering Industries. The film shows the advantages and ecenomy

HACKNEY "V" BLADE BLOWER
Installed with indirect heating plant

BLOWERS!?

HACKNEY "V" BLADE BLOWERS

Solid "V" Blade Construction
Long Life
Maximum Service
Minimum Cost

Write for our catalog and data book

Sales agents wanted in all territories

HACKNEY MANUFACTURING CO.
ST. PAUL, MINN.
Manufacturers of Blowers and Ventilating Equipment

Please mention THE HEATING AND VENTILATING MAGAZINE when you write.

"Sirocco" Air-Conditioning Apparatus installed in the factories of the Export Leaf Tobacco Co., Richmond, Va.

McNickle & McMahon Co., Richmond, Va., Heating and Ventilating Engineers

Dry air and dust are the enemies of tobacco workers. Dry air means dry tobacco with the resultant waste caused by breakage of brittle leaves. Dust means unhealthy workers because lungs become poisoned when breathing tobacco dust hours at a time, day in and day out.

"Sirocco" TRADE MARK

Air Conditioning Apparatus has changed this in many tobacco plants. Take the Export Leaf Tobacco Co., Richmond, Va., as an example. In this factory Sirocco Air Conditioning Equipment washes, purifies, cools and humidifies the air. It makes the tobacco just right for handling.

While the above applies to the tobacco factory, Sirocco equipment is in use in thousands of industries of various sizes and kinds for heating, ventilating and air conditioning.

Our sales engineers are at your service on any work where Sirocco is being considered.

AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN

that result when pipes and boilers are properly insulated and the radiation losses are thus overcome. The other picture is entitled, "The Story of Ingot Iron." Requests for the loan of these films should be addressed to the Bureau of Mines, 4800 Forbes, St., Pittsburgh, Pa.

New York—In connection with the convictions in the plumbing industry growing out of the Lockwood legislative investigation, the largest fine imposed on any member of the Hettrick group was that charged to the W. G. Cornell Company, Inc., one of the 52 firms that were indicted. This firm was one of the 38 which pleaded guilty. It was fined $10,000. Edward L. Slosson, its vice-president, who also was indicted and pleaded guilty, was sentenced to serve ten days in the City Prison. Before sentence was imposed upon him, however, Mr. Slosson took the stand and denied that he or his company had entered into any agreement with Hettrick or the Hettrick group to restrain competition. Other sentences imposed at the same time were two months in the Tombs for John L. Knight, president of the local master plumbers' association, and three months in the same prison for Charles A. Murphy, of Wells & Newton. The firm of Wells & Newton was also fined $5,000.

Washington, D. C.—According to the report of the Senate select committee on reconstruction and production, there is a shortage of 1,000,000 homes in the United States, and the scarcity is growing daily. The shortage is also nation-wide. No attempt is made to name the exact sum of money that will be required to bring about complete reconstruction, but need for approximately $15,000,000,000 is shown. Of this amount, 5,000,000,000 is needed for houses.

The remedies, according to Senator Calder's report, are better transportation, abundance of fuel, credit for loans and full information on the best method of construction.

To bring these remedies into operation, ten legislative measures are recommended. One is the coal bill, which failed to pass last session. Other measures are:

A bill to establish in the Department of Commerce a division for the gathering and dissemination of information as to the best construction practices and methods, technical and cost data and matters relating to city planning, etc., to encourage standardization and improved building practices throughout the country.

A bill to provide for the gathering and publication by existing governmental agencies of current facts as to production, distribution, available supplies, standards of quality, costs and realization of coal.

An amendment to the transportation act directing the Interstate Commerce Commission not to declare, without hearings, an emergency which will give preference of priority in transportation.

An amendment to the Federal Reserve act to permit the Federal Reserve Board to direct the use of savings and time deposits of national banks for long-time loans, "thus giving such deposits greater security and supplying a source of long-term money for home building."

A home loan bank bill to provide for district home loan banks which may sell, under Federal supervision, bonds secured by the aggregate loans deposited by the member banks.

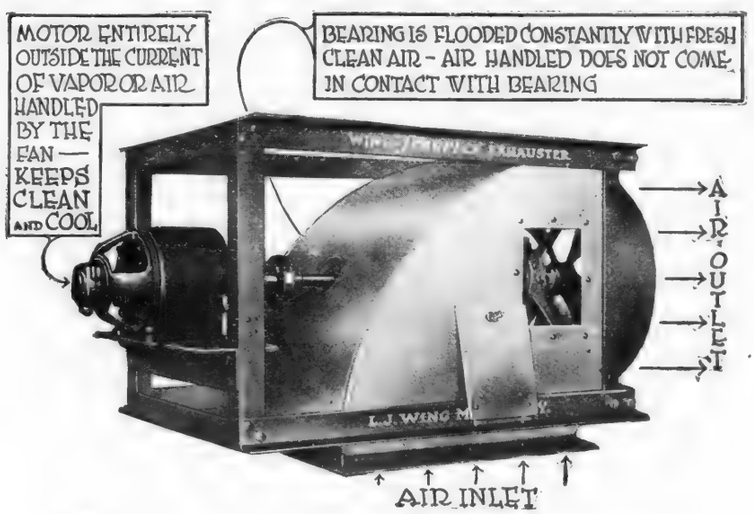
An amendment to the revenue act of 1918, limited to five years, to exempt from excess profits and income taxes the profits on the sales of dwelling houses where such profits, plus an equal amount, are reinvested in dwelling house construction.

An amendment to the revenue act to exempt from taxation interest on loans up to $40,000 on improved real estate used for dwelling purposes, when such loans are held by an individual.

An amendment to the revenue act limiting the taxation of profits from the sale of capital assets by providing for their taxation as of the years of accrual rather than as the year of their sale.

An amendment to the revenue act to limit the surtax upon saved income to an amount not in excess of 20% of such income.

Every ENGINEER SHOULD KNOW this EXHAUSTER


MOTOR ENTIRELY OUTSIDE THE CURRENT OF VAPOR OR AIR HANDLED BY THE FAN — KEEPS CLEAN AND COOL
BEARING IS FLOODED CONSTANTLY WITH FRESH CLEAN AIR - AIR HANDLED DOES NOT COME IN CONTACT WITH BEARING
AIR OUTLET
AIR INLET

Adaptable to any Hood or System of Ductwork

Supplied with any Inlet, Top, Bottom, or Either Side

The WING-SCRUPLEX EXHAUSTER
REG. U.S. PAT. OFF.

This unit combines the latest development in fan design.—The **Wing-Scruplex Fan**—with a housing of convenient form, in which the motor is easily accessible on the outside, clear of the path of the air being handled, where it will keep clean and cool. All working parts are entirely protected against injurious action of air or gases handled.

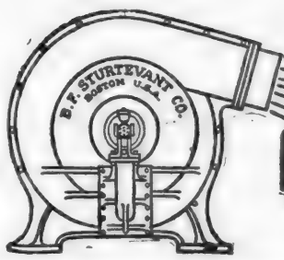
It economizes in:
Space, because it is installed as an elbow in run of duct;
Cost of Installation, because its cost is low and requires no heavy, expensive foundations;
Cost of Operation and Up-keep—perhaps more important than any other item of economy, because it is continuous.

Write for Descriptive Bulletin No. 58-B

Fans and Blowers all Types
Hudson and 13th Sts.

L. J. Wing Mfg. Co.

Damper Regulators
Small Turbines
New York City



Sturtevant

REG. U.S. PAT. OFF.

PUTS AIR TO WORK

AUDITORIUM COMFORT

THE final test of an auditorium is based on two practical considerations,—acoustics and ventilation. An error in these details will seriously impair a building of otherwise perfect design; th ir proper handling insures comfort to audience or congregation. There is a definite relation between the sciences of ventilation and sound transmission, and the experience of the Sturtevant engineers in many such problems is at the disposal of architects. Early consideration of heating and ventilating is of great importance to successful auditorium design.

The First Church of Christ, Scientist, at Rochester, N. Y., illustrated above, was designed by Gordon & Madden and Wm. G. Kaelber, Architects, A. S. Crocker, Consulting Engineer. Heating and ventilating are supplied by

STURTEVANT EQUIPMENT

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASS.

STURTEVANT BRANCH OFFICES

ATLANTA, GA.
306 Walton Bldg.

BOSTON, MASS.
555 Mass. Trust Bldg.

BUFFALO, N. Y.
100 Bedford Ave.

CHICAGO, ILL
530 So. Clinton St.

CINCINNATI, OHIO
601 Provident Bank Bldg.

CLEVELAND, OHIO
330 Guardian Bldg.

DALLAS, TEXAS
3411 Knight St.

DETROIT, MICH.
405 Marquette Bldg.

HARTFORD, CONN.
36 Pearl St.

KANSAS CITY, MO.
3820 Park Ave.

LOS ANGELES, CALIF.
411 Hollingsworth Bldg.

MINNEAPOLIS, MINN.
804 Met. Life Bldg.

NEW YORK, N. Y.
52 Vanderbilt Ave.

PHILADELPHIA, PA.
135 No. Third St.

PITTSBURGH, PA.
711 Park Bldg.

ROCHESTER, N. Y
1024 Granite Bldg.

ST. LOUIS, MO.
2036 Railway Exchange Bldg.

SALT LAKE CITY, UTAH
818 McIntyre Bldg.

SAN FRANCISCO, CALIF.
759 Monadnock, Bldg.

SEATTLE, WASH.
1105 1107 White Bldg

WASHINGTON, D. C.
1005 Loan & Trust Bldg.

B. F. STURTEVANT CO. OF CANADA, LTD.
GALT, ONT.

MONTREAL
404 New Birks Bldg.

TORONTO
210 Lumsden Bldg

An amendment to the postal savings law increasing the limitation on deposits as to amount and time and authorizing the rate of interest to be changed from time to time and providing for compensation of postmasters for the extra duties.

The report recognizes the present system of taxation as an important factor, but takes a firm stand against national, state or local governments attempting to relieve the housing situation by granting subsidies or by the erection of structures at government expense.

The proposal to establish a Federal housing division somewhere in the government which could be a clearing house for information as to construction, costs, city planning, and other housing facts, with a view to standardization of building codes and parts, has the earnest support of Secretary of Commerce Hoover.

Pease Laboratories, Inc., 39 West 38th St., New York, announce that Dwight Tenney, chief engineer of the Franklin Baker Company and prior to that connected with the engineering staff of the National Biscuit Company, has become associated with them as head of the newly-organized Department of Engineering. He will continue his connection with the former company as consulting engineer, having charge of all technical development work.

Bulletin of the Associated General Contractors for March, 1921, reports that "readjustment of wages in the building trades, which is widely recognized as a necessary step in effecting a return to healthy building activity, is now proceeding in numerous sections of the country. Reports received from 75 cities indicate that new agreements to be concluded shortly will provide for lower wage scales, and that before building can materially speed up, long-running agreements must also undergo a revision downward." In St. Louis and Chicago a clause has been inserted in new wage agreements providing that jurisdictional disputes shall be settled in accord with the awards of the National Board for Jurisdictional Awards in the Building Industry.

National Association of Master Plumbers will hold its 39th annual convention in New Orleans, La., June 7-9, 1921.

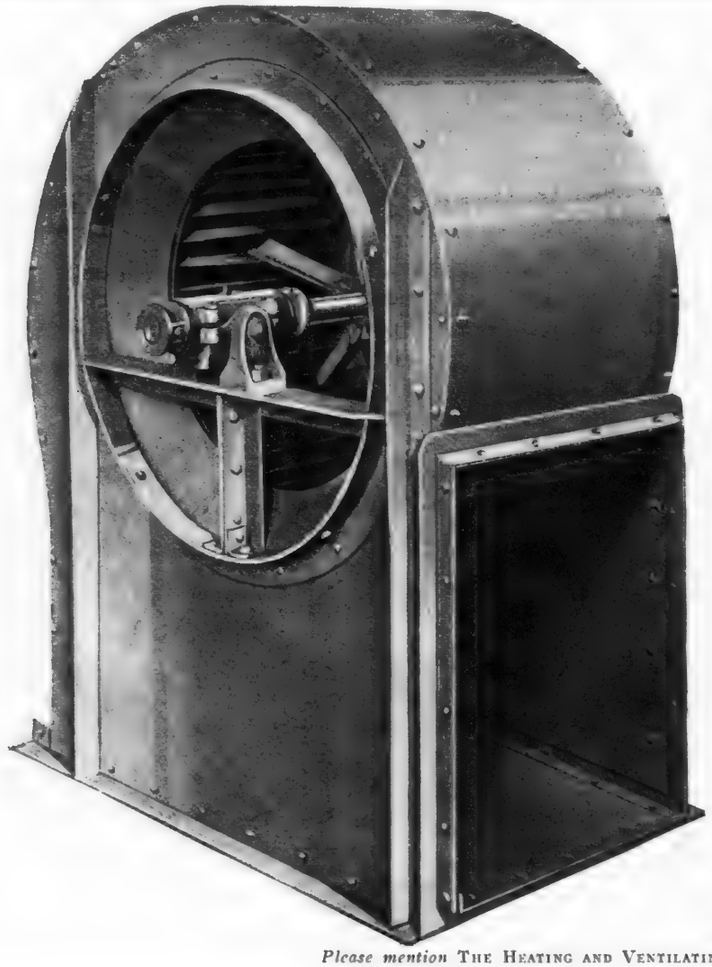
Building Age, which was published for many years as a sister publication of the Metal Worker, has passed into the hands of Frank Meyers, until recently eastern manager for the Edwin A. Scott Publishing Co., New York. Mr. Meyers has also purchased Motorcycle and Bicycle Illustrated and is organizing a new company to continue the publication of these two papers.

New York—A movement to standardize some method of selecting men and women with a view of placing the right person in a given job has been started in New York. Every employer who has ever pondered the problems of "hiring and firing" will probably follow with keen interest the development of this idea which was discussed at a luncheon given by George Kingdon Parsons, president of the G. K. Parsons Corporation, of New York. As a result of the conference a committee was formed consisting of Winslow Russell, vice-president and agency manager of the Phoenix Mutual Life Insurance Company of Hartford; Fowler Manning, sales manager for the Diamond Match Company; G. M. Lovelace, director of the School of Life Insurance Salesmanship of the Carnegie Institute of Technology of Pittsburgh; and Mr. Parsons, to communicate with the Personnel Research Federation and any other organizations interested in this work and thus begin to collect the information necessary for an evaluation of methods of choosing men.

Manufacturers' Notes.

Peerless Unit Ventilation Co., New York, manufacturer of the Peerless Unit ventilator for schools and other buildings, has moved to new quarters at 437 West 16th Street.

American Thermostatic Co., Charlotte, N. C., has made arrangements to



SERI-VANE FANS

are conservatively rated, giving that dependable assurance which means so much to careful Engineers, Contractors and Owners. You will find the same care is exercised in the manufacture of the product itself as is used in the compilation of the capacity tables.
When you want Fan satisfaction, specify

SERI-VANE FANS

THE NEW YORK BLOWER COMPANY
513 Transportation Building
CHICAGO

Factory: LaPorte, Indiana

Branch Offices in all large cities

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Altman Department Store, New York

Equipped throughout with batteries of Massachusetts Fans

Massachusetts
Modified "Squirrel Cage" Fans

possess the distinct and unusual advantage of "great capacity in small space," and this great capacity is obtained, not at a sacrifice of efficiency, but at higher efficiency than is possible with older forms of fans, For a given volume, it is smaller, cheaper in first cost and in cost of operation, The smaller wheel is driven at a higher rotative speed than was economical with the old paddle-wheel type; the smaller wheel at a higher speed means smaller motor and engines when direct connected, and these are also cheaper in first cost and operation.

MASSACHUSETTS BLOWER CO.
Watertown, Mass.

Branches in 20 principal cities throughout the country

establish a plant in Charlotte for the manufacture of thermostats and other heating devices which will be produced by the company. President, C. L. Brookshire.

Kennedy Co., Cleveland, O., has appointed J. H. Bacon as manager of its heating department. Mr. Bacon was formerly with the Mouat-Squires Co., of Cleveland.

Spang-Chalfant Co., Pittsburgh, Pa., has appointed Francis Worcester to a position in the company's sales department. Mr. Worcester was previously western sales manager of the Walworth Mfg. Co., of Boston. For a number of years before that he was attached to the Chicago district sales office of the National Tube Company.

Hoffman Specialty Co., manufacturer of the Hoffman siphon air valves, Hoffman return line air valves and other heating specialties, has removed its headquarters to Waterbury, Conn. The company is temporarily located at 29 Field Street, but will shortly occupy a portion of the new bank building now under construction in Waterbury. The company maintains a research laboratory in the plant of the Scovill Mfg. Co., in Waterbury, where all its products are manufactured. The New York office will be continued as a district sales office under the management of James K. Peacock.

Minneapolis Heat Regulator Co., Minneapolis, Minn., has opened a branch office in Philadelphia to serve the middle Atlantic States. The new office is located at 323 Bulletin Building, and is under the management of Arnold Michelson.

Fisher Governor Co., Marshalltown, Ia., manufacturer of power plant specialties, has appointed the Scheffler-Gross Co., Drexel Building, Philadelphia, as its district representatives. The company will carry in Philadelphia a stock of pump governors, pressure reducing valves, pressure regulators, steam traps and other Fisher specialties. The Sheffler-Gross Company will supplement the sale of this equipment with engineering service.

American Radiator Co., Chicago, Ill., has declared a quarterly dividend of 1% on its common stock, payable June 30, and 1¾% on its preferred stock, payable May 16.

Worthington Pump & Machinery Corporation, New York, has purchased the holdings of the War Department at its plant in Hazleton, Pa., at a cost of about $4,000,000. The purchase gives the company complete control of the plant. It is planned to start manufacturing operations at an early date, the plant having been idle for several months.

A. Harvey's Sons Mfg. Co., Detroit, Mich., is building a six-story reinforced concrete office and storage building on the site of the company's present quarters at Woodbridge and First Streets. The building will connect with a six-story branch building, 45 x 70 ft., already erected. The size of the new building will be 105 x 85 ft. The old quarters were one of the city's landmarks, having been occupied by the company since 1855.

Hersh Bros. Co., Allentown, Pa., manufacturers of Lehigh fans and allied products, announces the opening of a New York office at 523 Singer Building, under the management of F. M. Brissell.

Yeomans Bros. Co., Chicago, Ill., announces that in keeping with the general trend of prices, it has made a decided reduction in the prices of its products, which include sewage injectors and pumping machinery, the Shone pneumatic sewage ejector, electrically-operated centrifugal sewage ejectors, automatic electric bilge pumps, condensation return pumps and horizontal centrifugal pumps for all purposes.

Vapor Heating Co., York, Pa., announces the election as president of the company of Charles E. Scott, vice-president and manager of the New York office, filling the vacancy caused by the death of A. P. Broomell, president. J. W. Glassney, of Philadelphia, has been elected vice-president and will have the management of the Philadelphia office. William H. Koller will remain as secretary and treasurer. P. E. Sowers, who had charge of the engineering department of the New York office, will have charge of sales and engineering in that territory. The new president, Mr. Scott, has been connected with the Vapor Heating Company for a period of 15 years. He will

BUCKEYE
BLOWER COMPANY

Announce a further outlet for their products. We manufacture fans and blowers for

The Colby-Merrill Company
Cleveland Columbus Toledo

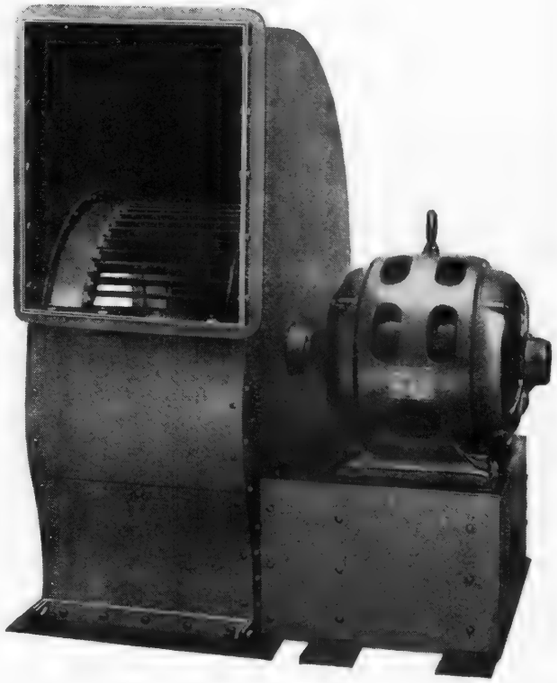
in whose name our product is marketed to the Heating and Ventilating trade in OHIO.

SERVICE ENGINEERING SALES

Write Our Nearest Office.

BUCKEYE BLOWER Co.
COLUMBUS, OHIO

ATLANTA--CHICAGO--CLEVELAND
PITTSBURG--TOLEDO



Westinghouse
Ventilating Equipment
in the
INDUSTRIAL PLANT

W
WESTINGHOUSE ELECTRIC

Westinghouse engineers have specialized in the design of high grade equipment for ventilating work.

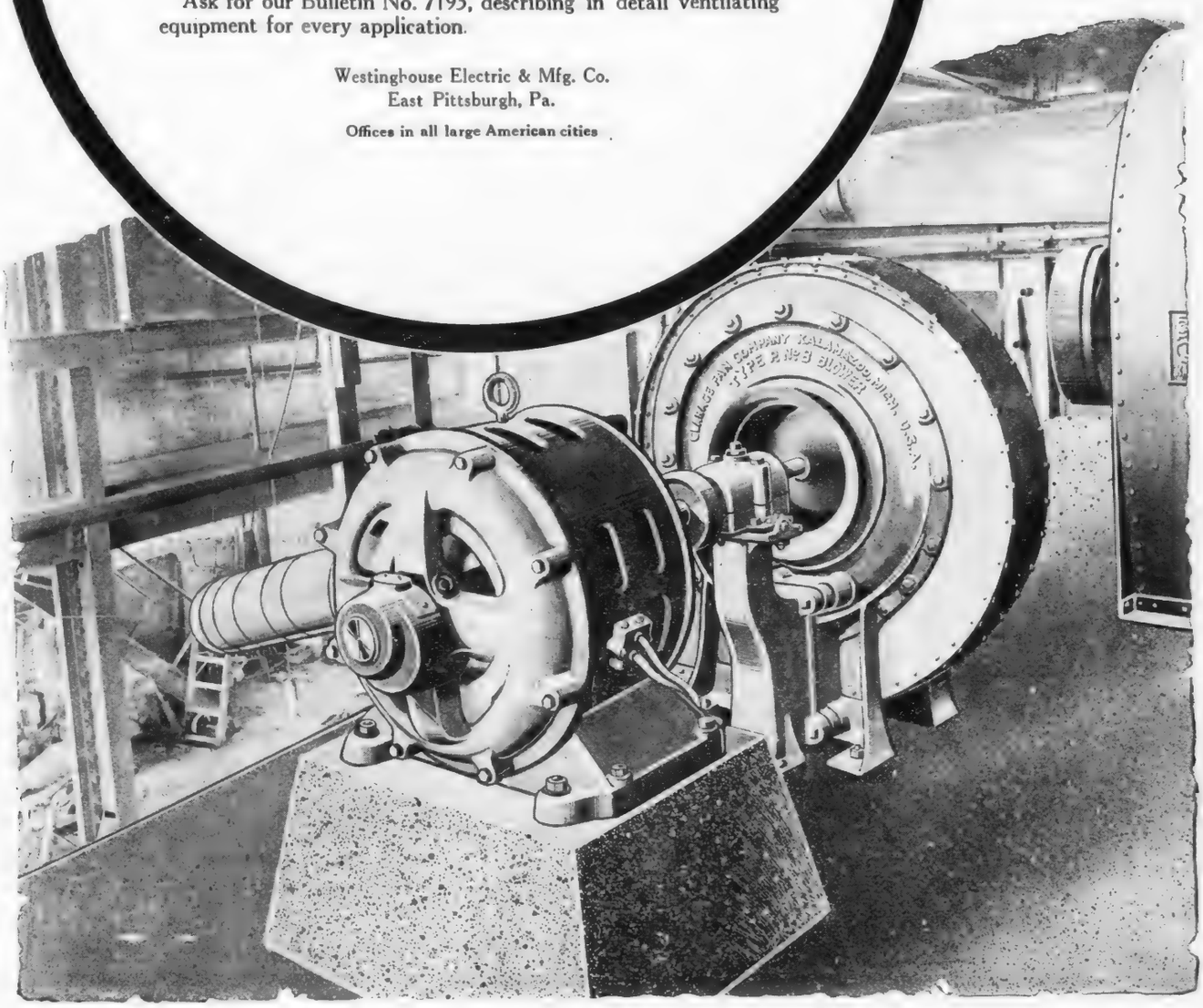
Motors and controllers have been designed for ventilating service in factory, home or school.

Big hotels, such as the Pennsylvania, in New York, and many factories and schools all over the country, are using this equipment and running it continuously day and night with practically no care or attention.

Ask for our Bulletin No. 7193, describing in detail ventilating equipment for every application.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

Offices in all large American cities



divide his time between the New York office and the main office in York.

New Incorporations

Fuel Oil Corporation, Brooklyn, N. Y., capital $2,000,000, to manufacture oil-burning devices, equipment, etc. Incorporators: John J. Dobson and others.

Haberstock Plumbing and Heating Co., Fort Wayne, capital $10,000, to install heating plants, electrical apparatus, etc. Directors: Anton Haberstock, T. J. Kucher and Matilda Haberstock.

Cunningham & Dewyea, Portland, Me., capital $10,000, to conduct a heating and plumbing business. President, Ernest X. Dewyea, South Portland; treasurer, Ernest N. Cunningham, Portland.

Newark Thermostat Co., Inc., Newark, N. J., capital $100,000, to manufacture mechanical and electrical devices.

New Firms and Business Changes

Harry B. Perrigo, Inc., is the title of a new heating and plumbing supply firm in New Haven, Conn., which has been formed by Harry B. Perrigo, for 30 years connected with C. S. Mersick & Co., of New Haven. The new company has acquired a building at Railroad Avenue and New Street, with 12,800 sq. ft. of floor space. The officers are: President and treasurer, Harry B. Perrigo; first vice-president, W. L. Harlow; second vice-president, Wilton M. Grant; secretary, Edmund A. Burwell; assistant secretary, Sherwin T. Haskell.

Grieg-Van Nattan Hardware, Plumbing & Heating Co., Springfield, Ill., is the new name of the Grieg-Westman Hardware, Plumbing & Heating Company of that place. The president of the company is D. E. Grieg and the secretary, J. A. Van Nattan.

American Plumbing & Steam Supply Co., Tacoma, Wash., has purchased the business of the Walsh & Gardner Co., of the same city, the purchase price being given as over $300,000. The consolidation of these two concerns gives Tacoma one of the largest heating and plumbing supply houses in the Northwest. The four-story building occupied by the Walsh & Gardner Co., will continue under the ownership of Mr. Walsh, being leased to the American Plumbing & Steam Supply Co. The officers of the company are: President, Joseph L. Long; vice-president, Martin A. Norman; secretary-treasurer, John W. Horejs.

New Home of L. J. Wing Mfg. Company

This month marks an important step in the progress of the L. J. Wing Mfg. Company in the removal of the Company's present quarters in New York, where they have been located for a good many years, to a new building just completed for the company in Newark, N. J., on Victoria Street, near Frelinghuysen Avenue (Lincoln Parkway). The new building has been designed as a model plant in every respect and will house the company's general offices and factory, affording 50% more floor area and ample ground space surrounding the building for storage purposes and future expansion. The new Wing home is directly served by six trunk line railways by a private siding directly on the company's own property. This, it is stated, will shorten delivery dates by from two to three days.

Several times in its history, the L. J Wing Mfg. Company has outgrown its quarters. While the company still manufacturers the original Wing disc fan, the popularity of its new products is no doubt largely responsible for its rapid growth. Within the past few years the company has brought out the Wing-Scruplex fan, the Wing-Scruplex exhauster, the Wing-Scruplex unit heater and the Wing turbine blower.

It will be of interest to know that in the design of the Wing-Scruplex fan, advantage was taken of the exhaustive experimental work carried on during recent years to determine the most efficient propeller for airplanes. The fact that the latest types of airplane propeller blades so closely resemble those used in the Wing-Scruplex fan is considered a substantiation of the results of the company's own experimental work. The Wing-Scruplex exhauster, which has more recently

LEHIGH

NEW YORK OFFICE

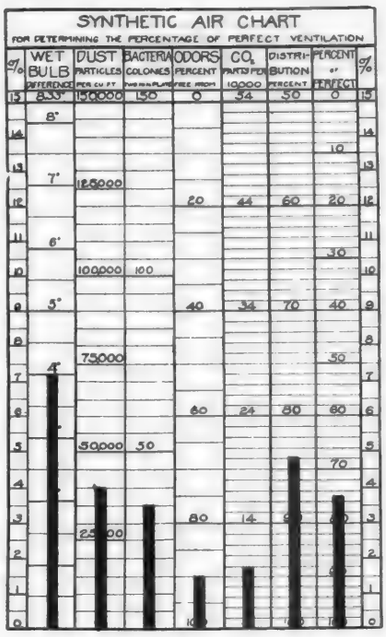
The rapid growth of the sales of Lehigh Fans and allied products has necessitated the opening of a sales office in New York City.

This office, under the management of Mr. F. M. Brissell, is located at 523 Singer Building.

The careful attention to detail that has stamped Lehigh service as something distinctive will be the dominant note of this—the most recently opened sales office.

HERSH BROTHERS COMPANY
655 MILL STREET
ALLENTOWN, PENNA.

Efficiency-Comfort-Health


SYNTHETIC AIR CHART
FOR DETERMINING THE PERCENTAGE OF PERFECT VENTILATION
WET BULB DIFFERENCE
DUST PARTICLES PER CU. FT.
BACTERIA COLONIES PER MM. PLATE
ODORS PERCENT FREE FROM
CO2 PARTS PER 10000
DISTRIBUTION PERCENT
PERCENT OF PERFECT

Test of a poorly ventilated school room. Chart shows final percentage of 75.

All depend in a large measure on the air conditions under which we live.

It is a serious matter to guess about.

A Chart Test shows at a glance what the air conditions are and how they should be improved,

← 75% Which is Yours? 95% →

E. Vernon Hill Co.

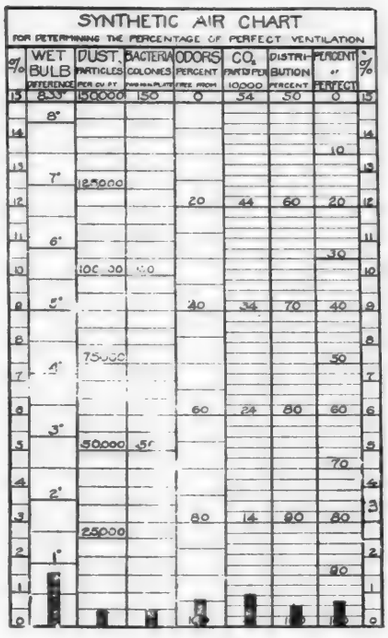
Aerologists

Specialists in Testing, Ventilating, Air Conditioning, Humidifying, Drying Equipment, etc.

Manufacturers of Special Air Testing Instruments

117 N. Dearborn St.

CHICAGO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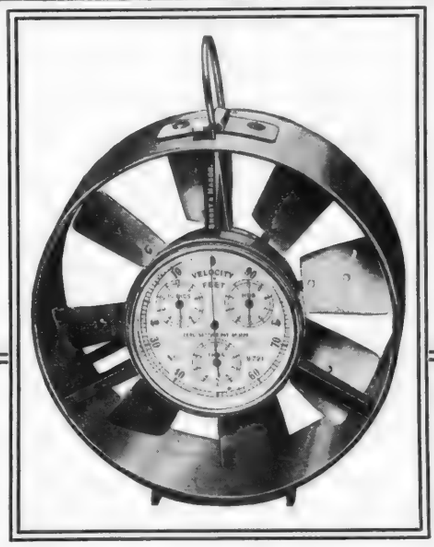
Test of a well ventilated factory. Chart shows a final percentage of 95.



Tycos Anemometer

Measures air currents of 100 to 3,000 feet per minute in mines, tunnels, shafts, airways, etc.

Instantaneous zero setting without use of key. Jewelled bearings. Enamel dial boldly figured. Threaded socket for attaching to foot, permitting use in otherwise inaccessible places. English sole leather carrying case. Calibration charts for velocities up to 3,000 feet per minute.

Taylor Instrument Companies

ROCHESTER, N. Y.

There's a *Tycos* or *Taylor* Temperature Instrument for every purpose

760

FITTING SPACE

With an Air Washer

MEL-ROCK AIR WASHERS fit the allotted space because:—

Each capacity is regularly made in from four to seven different sizes and proportions—without affecting capacity.

MEL-ROCK Mist Nozzles discharge a greater volume of mist, of a better quality, at lower pressure.

MEL-ROCK Eliminator Systems are made in *batteries*, riveted at the factory. Setting up is a simple, time-saving process.

Mel-Rock is the modern air washer. Send for descriptive catalog.

MEL-ROCK PRODUCTS
TRADE-MARK

MELLISH-HAYWARD COMPANY

213 W. Austin Av.

CHICAGO

been placed on the market, combines the Wing-Scruplex fan with a housing or casing in which the bearings are protected from the action of the air being handled. In the Wing-Scruplex unit heater, the fan is combined with a compact encased heating unit, with a novel type of air-distributing nozzle which is described as highly efficient.

P. M. Beecher has resigned as manager of the boiler department of the Utica Heater Co., Utica, N. Y., and until he has made some other business connection his address will be 598 West 191st Street, New York City.

Major Harry B. Joyce, formerly of the Construction Division of the Army, has resigned as a member of the firm of Johnson & Benham, Inc., consulting engineers, to assume charge of the engineering work of the Centrifugal Fan Co., Newark, N. J., manufacturers of the Four-Leaf Clover fans and exhausters. Previous to his service in the Army, Major Joyce was power engineer for the United Electric Light & Power Co., New York.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceeding date of issue.

Position Wanted

Young man, finished heating and ventilating and mechanical equipment engineer, desires an executive position. Now employed; 7 years experience; thirty years of age; locate anywhere that character of position warrants. Salary required $5200 per year. Available promptly. Address Box "R," care of Heating and Ventilating Magazine.

Heating and Ventilating Engineer

Technical training preferred. Familiar analysis industrial problems; construction and design of fan and blower systems. Interstate Business Exchange, 658 Rose Bldg., Cleveland, O.

Wanted—Engineer thoroughly familiar with fan and blower installations for all purposes. Having ability to layout and design. Sales experience desirable, but not essential. Address Box "T," care of Heating and Ventilating Magazine.

WANTED—REPRESENTATIVES. Splendid opportunity for manufacturers agents or salesmen who are in touch with architects and engineers in the building trades to sell complete and established line of stationary vacuum cleaners. Liberal commission. Good territory now open. Address "W. G. K." care Heating & Ventilating Magazine, 1123 Broadway, New York.

Wanted—Capable man, with knowledge of heating, to assist in marketing a combustion efficiency device, Manhattan and Bronx. Guaranteed saving 25% coal and one-third labor. Used and endorsed by leading apartment owners in New York. Large income. All-year business. No investment, but must wait for to six weeks for first returns. Profit sharing. Box 38, care of Heating and Ventilating Magazine.

Vento Return Line Valve

for Vacuum and Vapor Heating Systems is a fuel-saver from the moment that it is put to work on the heating system. It never fails in its promise to make the heating system give dollar-for-dollar service for every ounce of fuel consumed.

Our latest Booklet "The Perfect Heating System," will be mailed on request to any heating engineer.

WM. S. HAINES & COMPANY
Philadelphia

PECO

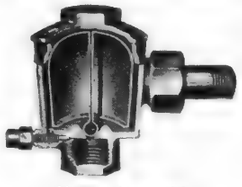
"The System with a Record"

Over thirty plants "Pecoized" for one company

20% to 40% fuel saving

Let us talk over your condition with you

The Fool-Proof Valve



Non-adjustable
Positive in action

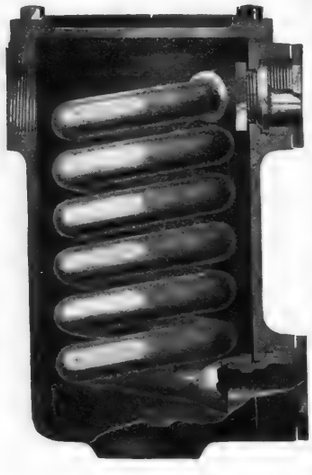
Catalog on request

PITTSBURGH ENGINEERING CO.
Mfrs. Peco Vacuum System of Steam Heating and Drying
JEANNETTE PENNSYLVANIA

AIR CONDITIONING TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC CONDITIONING CORPORATION
LAFAYETTE BLDG.
PHILADELPHIA



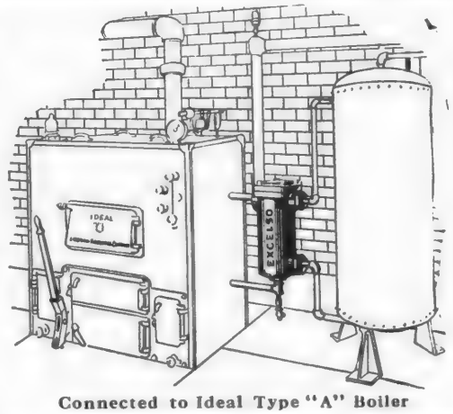
The New Excelso Water Heater

Eliminates Fire-Pot Pipe Coils

The Excelso Heater, connected below the waterline of steam or vapor boilers, will generate domestic hot water constantly, day and night, as long as there is any fire, at practically no cost.

The copper coil is connected into heater without packing. Made in five sizes for tank capacities as follows:

No. 11	No. 12	No. 13	No. 14	No. 15
30 gal.	45 gal.	70 gal.	90 gal.	120 gal.



Connected to Ideal Type "A" Boiler

EXCELSO SPECIALTY WORKS
119 Clinton St. Buffalo, N. Y.

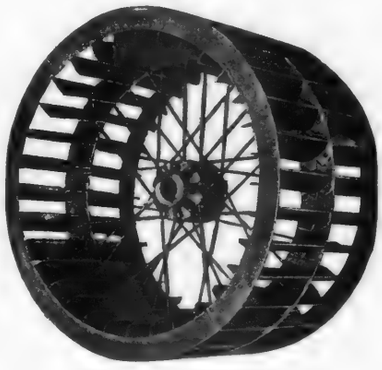
Bayley

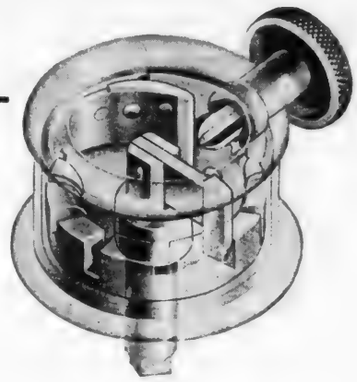
Plexiform Fans

deliver a maximum volume of air at a minimum expense for power and upkeep, because they are perfectly balanced on a machined center, running in ring oiling bearings, and have blades designed to reduce the air friction co-efficient to a negligible minimum.

Bulletin and investigation by our engineers are yours for the asking. Right now is a good time to ask.

Bayley Mfg. Co.
Dept. E
Milwaukee, Wis.

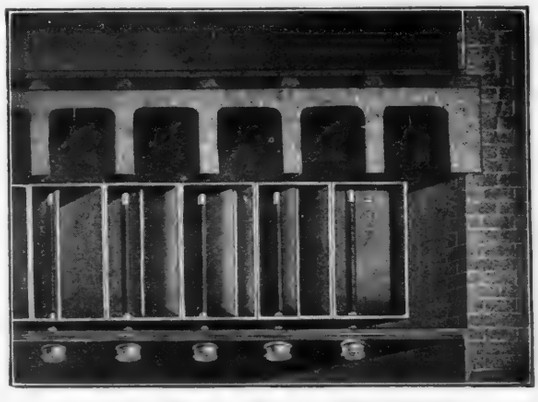




This is the Key to Good Ventilation

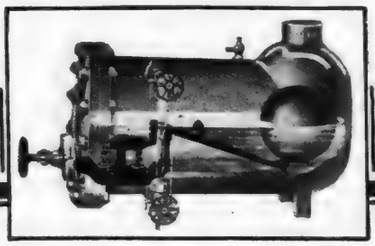
THE PERFECTO DAMPER REGULATOR AND INDICATOR

when placed on a battery of ducts in the collecting chamber near the machinery room, not only affords an easy and convenient means of regulating the flow of air, but also serves as a positive means of indicating the room to which each duct leads, by means of the numbered or lettered cover windows.



Let us send you further particulars

The Sixth City Sheet Metal Works Co.
Cleveland, Ohio
Office and Factory, 1830 St. Clair Avenue



A Steam Trap with a wide Range of Application

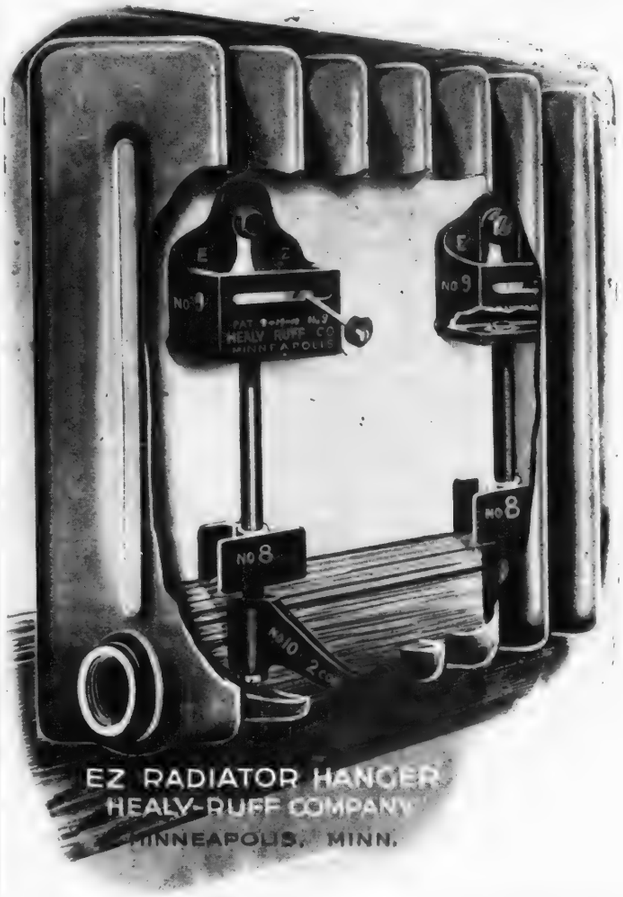
Wherever water of condensation is to be removed from steam lines—there you need the Davis Improved Steam Trap. The Davis Trap is suitable for all heating work. It economically removes all condensed water from steam without loss and with great saving thru dependable operation and negligible upkeep.

Valves are isolated from inlet, so are not injured by incoming foreign matter; sleeveless valve construction prevents clogging with sediment, scale, grease, etc.; valve seats are of Tobin bronze and are renewable. Valve casing is of non-corrosive steam metal.

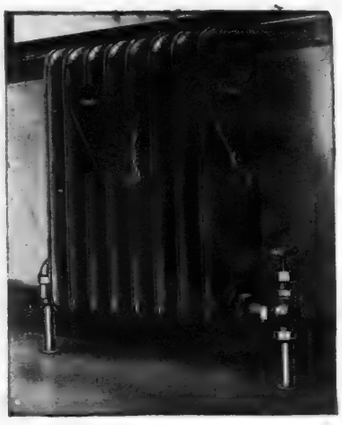
Parts are readily accessible without breaking steam line. by removing cover to which all working parts are attached.

Write to the G. M. Davis Regulator Co., 436 Milwaukee Ave., Chicago, for a catalog which describes this and the many other Davis steam-savers. Every heating engineer should have a copy.

DAVIS VALVE SPECIALTIES
STEAM SAVERS SINCE 1875



HARTMANN RADIATOR BRACKETS



WHYS

LABOR SAVED

NO WALL STRIPS

NO BREAKAGE

NO DIRT

INEXPENSIVE

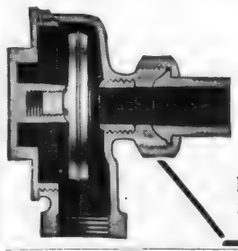
Send for descriptive circular and price list

CHARLES HARTMANN CO.
SHEET METAL CONSTRUCTORS
985 Dean St., Brooklyn, N. Y.

The "IDEAL" Trap

IN NAME - IN PRINCIPLE - IN SERVICE

For all Return Line Heating Systems—
Vapor, Vacuum or Straight Steam



1. Fool Proof.
2. Less Complicated.
3. A "Protected" Diaphragm.
4. Vertical Self Cleaning Seat.
5. Highest Radiator Efficiency.

Ideal Heating Equipment Co.
1897 E. 90th St. Cleveland, Ohio

Ross

Surface Barometric and Jet Condensing Equipments for Power Plants. Main, Auxiliary, Distilling Condensers & Evaporators for Marine Service. Distilling Condensers for Refrigeration and Chemical Plants.

"Crosshead Guided" Expansion Joints.
Ross Boiler Feed Water Heaters.
Ross Oil and Sugar Juice Heaters.
Gravity & Forced Circulation Heaters.
Ross Oil, Air and Water Coolers.

ROSS HEATER & MFG. CO., Buffalo, N. Y.

THE BRAND THAT LEADING ENGINEERS DEMAND

Where the Buyer Benefits

How More Favorable Buying Conditions Are Being Created by Advertising in This Paper at This Time

Through regular advertising, sellers are making buying opportunities, instantly available. By publicly committing themselves in their advertising, they are giving you a strong assurance of faithful performance.

Advertisers are cutting sales costs through the use of advertising as a SALES MACHINE just as they reduce production costs by improved machinery methods.

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Each has subscribed to and is maintaining the highest standards of practice in its editorial and advertising service.

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American Funeral Director
American Hatter
American Machinist
American Paint Journal
American Paint and Oil Dealer
American Printer
American School Board Journal
Architectural Record
Automobile Dealer and Repairer
Automobile Journal
Automotive Industries

Bakers Weekly
Boiler Maker
Boot and Shoe Recorder
Brick and Clay Record
Buildings and Building Management
Building Supply News
Bulletin of Pharmacy

Canadian Grocer
Canadian Machinery and Mfg. News
Canadian Railway and Marine World
Candy and Ice Cream
Chemical & Metallurgical Engineering
Clothier and Furnisher
Coal Age
Coal Trade Journal
Concrete
Cotton

Daily Metal Trade
Distribution and Warehousing
Domestic Engineering
Dry Goods Economist
Drygoodsman
Dry Goods Reporter

Electric Railway Journal
Electrical Merchandising
Electrical Record
Electrical World
Embalmers' Monthly
Engineering and Contracting
Engineering and Mining Journal
Engineering News-Record

Factory
Farm Implement News
Farm Machinery—Farm Power
Fire and Water Engineering
Foundry (The)
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Furniture Merchants' Trade Journal

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Gas Record
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Haberdasher
Hardware Age

This means ability to make LOWER PRICES to you.

Advertising in a buyer's own paper caters to his convenience; it saves the buyer's time; it helps the buyer weigh and balance rival claims; when the salesman calls, it saves the time of both buyer and salesman by providing the foundation for intelligent judgment.

None but good concerns are admitted to the advertising pages of members of The Associated Business Papers, Inc.

The seller who is building reputation through advertising will jealously guard that reputation in every transaction, beginning with the merit of the merchandise.

Advertising indicates progressiveness, not alone in selling, but throughout the entire business.

By advertising, the seller is publicly displaying his ability and desire to serve you, instead of silently relying upon the necessity of the buyer to produce orders.

You are invited to consult us freely about Business Papers or Business Paper Advertising

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Hide and Leather
Hospital Management
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Inland Printer
Iron Age
Iron Trade Review

Lumber
Lumber Trade Journal
Lumber World Review

Manufacturers' Record
Manufacturing Jeweler
Marine Engineering
Marine Review
Millinery Trade Review
Mill Supplies
Mining and Scientific Press
Modern Hospital
Motor Age
Motorcycle and Bicycle Illustrated
Motor Truck
Motor World

National Builder
National Petroleum News
Nautical Gazette
Northwest Commercial Bulletin
Northwestern Druggist
Nugent's, The Garment Weekly

Oil News
Oil Trade Journal

Plumber and Steam Fitter
Power
Power Boating
Power Farming Dealer
Power Plant Engineering
Price Current—Grain Reporter
Printer's Ink

Railway Age
Railway Electrical Engineer
Railway Maintenance Engineer
Railway Mechanical Engineer
Railway Signal Engineer
Retail Lumberman
Rubber Age

Shoe Findings
Shoe and Leather Reporter
Shoe Retailer
Southern Engineer
Southern Hardware and Implement Journal
Sporting Goods Dealer
Starchroom Laundry Journal

Tea and Coffee Trade Journal
Textile World

Welding Engineer
Woodworker

THE ASSOCIATED BUSINESS PAPERS, Inc.

JESSE H. NEAL, Executive Secretary

HEADQUARTERS - 220 WEST 42nd STREET - NEW YORK CITY

A NEW EFFICIENCY DEVICE

The Time Punch for Columbia Recording Thermometers

You can now order your fireman, operator or night watchman to keep a sharp eye on temperature variations in any heat-treat process, or for heat regulation in operating efficiency—*and by instructing him to use the TIME PUNCH at stated hours or minutes* YOU CAN BE SURE THAT YOUR ORDERS ARE CARRIED OUT.

The TIME PUNCH makes a small hole in the time border of the chart *the very second the button is pressed.* It makes the Columbia Recording Thermometer *a time clock* as well as a heat-recording device.

No chance now for the employee in charge of heat-regulation to shirk or misrepresent. The little punch hole tells you whether or not he has been on the job. If he doesn't "ring up" at regular intervals, those tell-tale marks will stand against him. Side by side with the graph line that indicates temperature fluctuations are the indelible marks that tell you whether he has or *has not* been attending to his duties.

By checking up on the individual who is responsible for proper heat regulation, you can be pretty sure that he will not permit the line to waver.

The TIME PUNCH makes the Columbia Recording Thermometer doubly valuable. The chart gives you a 24-hour record of temperature changes. The TIME PUNCH, by compelling vigilance on the part of the operator, gives you the assurance that definite instructions as to temperature will be carried out! Its use is your protection against losses mounting up to hundreds and perhaps thousands of dollars.

This new TIME PUNCH is also supplied on Columbia Recording Gauges and Tachometers.

Send for Recording Thermometer Catalog H-14.

THE Schaeffer & Budenberg MFG. CO.

Makers of instruments for the promotion of efficiency in Power Plant and Manufacturing Departments.

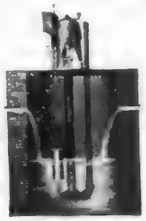
Chicoga Philadelphia
Detroit Washington
Atlanta Pittsburgh
Los Angeles
San Francisco
Toronto, Ont.

Columbia Recording Thermometers

CELLAR DRAINERS
AUTOMATIC ELECTRIC
7 TO 500 GALLONS MINUTE

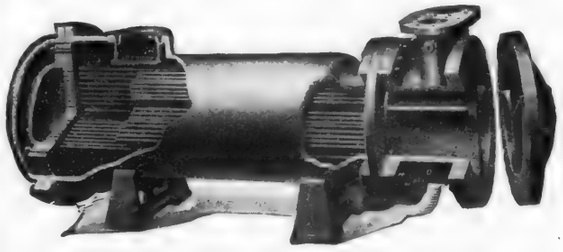
SEWAGE EJECTORS
AND
BILGE PUMPS
30 TO 3000 GALLONS MINUTE

ABSOLUTE GUARANTEES



ECONOMY PUMPING MACHINERY CO.
120-126 No. Curtis St., CHICAGO

Plenty of Hot Water ALWAYS



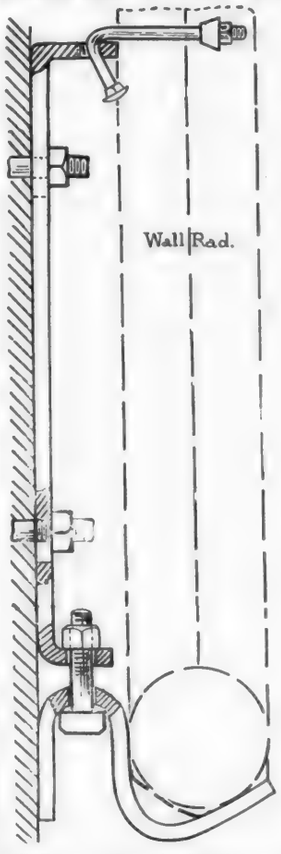
G-R Instantaneous Heater

Send for Bulletin 231

The Griscom-Russell Co.
2155 West St. Building New York
OFFICES IN PRINCIPAL CITIES

GLEOCKLE WALL RADIATOR BRACKET

(Patented)



Possesses Advantages of

Universal Adjustment

Ease of Erection

Made of Wrought Iron

Unbreakable

Rustless

Fitting all Makes of Wall Radiators

Available for Immediate Shipment

Write for Descriptive Booklet and Trade Discounts

A. F. Gleockle, Jr.
415 Bay St.
ROCHESTER, N. Y.

Get Ready Now to Save 20 to 30% of Next Winter's Fuel

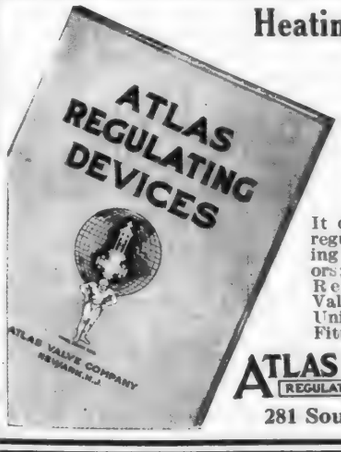
INSTALL Adsco Heating this summer—or change over your unsatisfactory system. Adsco Heating uses any desired portion, large or small, of any radiator. It saves steam by never over-heating radiators. This absolute control of steam will save 20 to 30% of your fuel cost.

No air valves, no vacuum pumps, no radiator traps, no complicated devices are used. Adsco Heating never makes noise. It is the most commonsense method of heating. Costs 15 to 20% less to install than most other systems.

SIMPLE FLEXIBLE ECONOMICAL

AMERICAN DISTRICT STEAM COMPANY
GENERAL OFFICES AND WORKS
NORTH TONAWANDA, N.Y.
BRANCHES
New York Chicago Seattle

Ask about Adsco Heating of building groups from Central Station Steam Plant—Bulletin 20-H; for individual buildings, Bulletin 150H.



Heating and Ventilating Engineers!

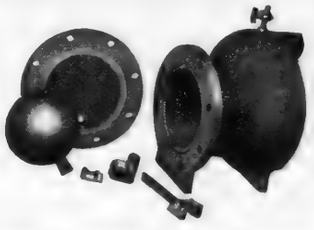
You are entitled to a copy of this

General Atlas Catalog

It describes our full line of regulating devices—Reducing Valves; Pump Governors; Vacuum and Pressure Regulators; Balanced Valves; Float Valves; Bronze Unions and Swing Joint Fittings.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
281 South St., Newark, N. J.

What MAKES a Steam Trap



The *body* is only a receiver or reservoir for the inflowing water of condensation.

The *float* or bucket is the actuating medium for the discharge of the water.

But it is the VALVE that makes the trap.

A plug-and-socket valve, a poppet valve, or a needle valve—moves in and out repeatedly—from the seat, to the seat. Result is wire-drawing, wear and tear and WASTE OF STEAM by leakage.

CORLISS VALVE STEAM TRAPS

cannot wire-draw because the VALVE never leaves its seat. It is an oscillating Corliss Valve that *automatically compensates for wear.* The Corliss Valve Trap is a sturdy, honest steam trap, made up of only six parts. It drains positively under any high or low pressure condition. It insures positive circulation and is

Guaranteed for Two Years

against wire-drawing, leakage of steam or repairs.

Write for Complete Information

PLANT ENGINEERING AND EQUIPMENT CO. INC.
192 Broadway New York, N. Y.

STERLING SYSTEMS

STERLING SYSTEMS

Vacuum and Vapor Heating Specialties

Thermostatic Traps—Air Line Valves—Graduated Supply Valves—Air Eliminators—Damper Regulators—Return Traps

STERLING ENGINEERING COMPANY
Milwaukee Wisconsin

Banner Rock Wool Quilt
100% Fire Proof

INSULATION
FOR
HOT SURFACES

Cut shows typical installation of Banner Rock Wool Quilt on Boiler of Apartment House after 4 Years' Service

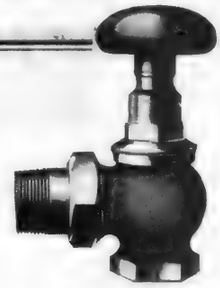
DISTINCT ADVANTAGES.

1 MOST EFFICIENT (by Government tests)
2 EASE OF APPLICATION
3 FLEXIBILITY
4 CAN BE TEMPORARILY REMOVED TO MAKE REPAIRS
5 LOWEST INITIAL COST

"More Insulation for Money Invested"

Send for Information

Banner Rock Products Co.
Alexandria, Ind.



"Genuine Detroit" Packless Radiator Valves

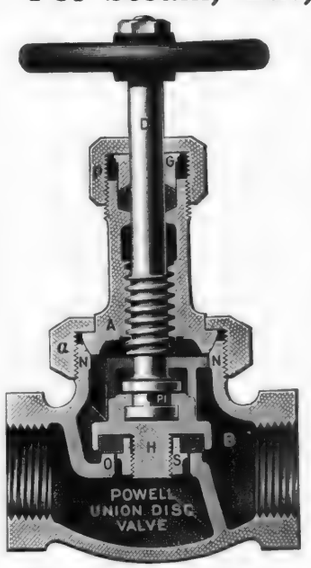
Detroit Packless Radiator Valves are the result of years of experience in the valve manufacturing field—of a careful study of valve needs—of painstaking care on the part of our engineers.

So well do these valves qualify for efficient service—for handsome design and pleasing appearance—for complete satisfaction, that leading architects, heating engineers and master builders, the country over, recommend and specify them for jobs that require the most careful consideration.

They are made for steam, vapor and vacuum heating systems—in all necessary sizes and a variety of styles. Let us send booklet giving full information.

DETROIT LUBRICATOR COMPANY.
DETROIT, U.S.A.

POWELL VALVES
Union UNION COMPOSITE DISC VALVE Disc
For Steam, Gas, Oil or Air



Notice the Union Bonnet Connection

Steam Bronze Composition Body and Trimmings

Vulcanized Composition, White Metal or Bronze Discs

Screwed or Flanged Ends

Ask for
POWELL UNION DISC VALVES
THE WM. POWELL CO.
CINCINNATI, OHIO

Meet that Peak Demand for Hot Water

WITH A

Sims Clean E-Z Steam Tube Heater

For Hotels, Apartment Buildings, Hospitals, Y. M. C. A. Buildings, Schools, etc.

For Live or Exhaust Steam

Especially Designed for Supplying Large Quantities of Hot Water

Send for tables showing heat capacities using steam at various pressures

"We keep others in hot water"

THE SIMS CO., 18th St., Erie Pa.

Every Heating Engineer Knows the Advantages of Copper Over Iron

SPECIFY

DAHLQUIST

Copper Boilers

Let us figure on your requirements

DAHLQUIST MFG. CO.
40 West 3rd St. BOSTON, MASS.

You Need This Portable Power Drive

EVERY plumbing or steam-fitting contractor who has watched a "Toledo" Drive at work, has been amazed at its simplicity—its utility—its speed—its ease of operation and its economical upkeep. No drive for portable pipe tools can compare with the "Toledo" for all-around excellence. You need one. Write for details.

The Toledo Pipe Threading Machine Co., Toledo, O.

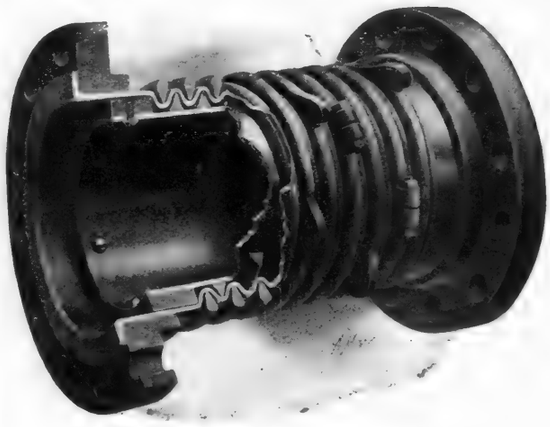
N. Y. Office:
50 Church St.

TOLEDO DRIVE
PORTABLE POWER

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

"WAINWRIGHT"

Improved High Pressure Expansion Joints



Wainwright Improved Expansion Joint

These joints of corrugated copper with reinforcing rings so arranged as to distribute the movement equally between the several corrugations are offered for steam, gas or oil lines, for not exceeding 150 pounds pressure per square inch. This design has given satisfaction where "competition" joints with fewer corrugations have failed.

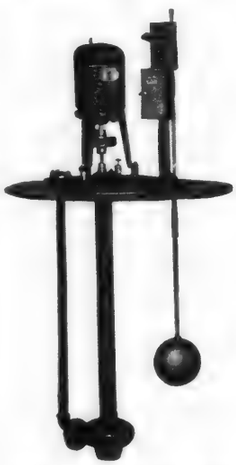
Bulletin on Request

ALBERGER PUMP & CONDENSER COMPANY

140 Cedar Street, New York

Boston Chicago St. Louis Philadelphia

Our New "L" Type BILGE PUMP



Heavy duty—large shaft and bearings.

Oil immersed, radial-thrust ball bearing.

Pump can be removed without disturbing automatic apparatus on basin cover.

DRAINAGE INSURANCE

means a good pump in the cellar.

It insures a dry basement and freedom from grief. A poor one is worse than useless—insures perpetual worry. What if a good pump does cost just a little more? It saves the difference in the first emergency.

The Wise Contractor uses the best equipment he can get. And thereby escapes the "COME-BACKS."

BE A WISE ONE

Profit by our life-time of specialized experience.

Ask for Our New Catalog

It tells all about our other products—

Sewage Ejectors, Condensation Pumps, Return Line Vacuum Pumps, Turbine House Pumps, Hot and Cold Water Circulating Pumps.

CHICAGO PUMP COMPANY

2325 Wolfram St. Chicago, Ill.

MARSH RE-ENFORCED PACKLESS VALVES

Quick Opening

Note General Lines Carefully

The **ONLY Packless** and **Modulated** Valves in which the **Packless Feature,** although a **positive seal within itself** and **practically indestructible,** is, through a packing cushion and a very heavy special spring, **automatically reenforced,** providing **two or double, independent, positive,** bonnet seals at **all times.**

These valves will withstand high pressures and, therefore, are of **superior value** for **vacuum** and **low pressure service.**

We specialize on high grade Radiator Valves and furnish the largest line of any company in the business

Printed matter and prices on application

MARSH VALVE CO., Erie, Pa.

FOR UNDERGROUND STEAM OR HOT WATER PIPES
THE EFFICIENT
RIC-WIL METHOD

means the practical elimination of heat losses. RIC-WIL installations commonly show efficiencies of 85% —there are cases where it has shown better than 90%. And not for a week or a month, but continuously, and after years of service. This means just one thing—economy—conservation of the coal pile. Economy is the *only* reason why underground pipes are insulated at all: it is the *best* reason why they should be insulated by the RIC-WIL METHOD.

Write to-day for our catalogue.

The RIC-WIL COMPANY
CLEVELAND

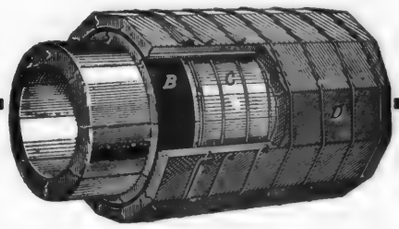
Alberger
Buffalo

BUFFALO MULTI-HEAD HEATERS

For forced and gravity circulation heating systems. Installed for such firms as Ford Motor Company, Lincoln Motor Company, American Woolen Mills, Fisher Ohio Body Company, American Can Company, U. S. Government and many others.

Write for Catalog No. 3

ALBERGER HEATER CO.
BUFFALO, N. Y.



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes with

Wyckoff's
Improved
Cypress Covering

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Absolutely water and steam tight. Each shell is wound with extra-heavy steel wire. Coated all over with the best known preservative—**Montezuma Asphalt.**

Write for catalog

A. WYCKOFF & SON CO.
ELMIRA, N. Y.

PYRO-BESTOS

Underground Pipe Insulation

For piping from central heating plants or power stations to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also an underground Pipe Conduit for heating private Auto Garages direct from House heating systems.

Cannot rot or decay nor will it retain moisture to rust and destroy the piping during non-heating season.

Saves most coal, sends dry steam to a greater distance and by reason of its advanced common sense method of installation is at the same time a lower cost per foot of pipe covered than any other Underground Pipe Insulation on the market.

National Asbestos Mfg. Co.
163-193 Henderson Street, Jersey City, N. J.

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Carrier Engineering Corporation, New York.
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New York Blower Co., Chicago, Ill.
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Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

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Hoffman Specialty Co., New York.

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Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo. N. Y.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Hersh Brothers Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Mellish Hayward Co., Chicago, Ill.
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Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hackney Mfg. Co., St. Paul, Minn.
Hersh Brothers Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

Pressure.

American Blower Co., Detroit, Mich.
Batterman-Truitt Co., Chicago, Ill.
Buffalo, Forge Co., Buffalo, N. Y.
Connersville Blower Co., Connersville, Ind.
Hersh Brothers Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

Rotary.

Connersville Blower Co., Connersville, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

Turbine.

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Plant Eng'g & Equipment Co., New York.
L. J. Wing Mfg. Co., New York.

BOILER BREECHINGS.

Hartmann Co., Charles, Brooklyn, N. Y.
Johns-Manville, Inc., New York.

BOILERS.

Copper.

Dahlquist Mfg. Co., Boston, Mass.

Heating.

American Radiator Co., Chicago, Ill.
Abram Cox Stove Co., Philadelphia, Pa.
Gorton & Lidgerwood Co., New York.
Gurney Heater Mfg. Co., Boston, Mass.
Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co. Utica, N. Y.
Page Boiler Co., Wm. H., New York.
Standard Heater Co., Williamsport, Pa.
Utica Heater Co., Utica, N. Y.

Down-draft.

American Radiator Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Page Boiler Co., Wm. H., New York.
Utica Heater Co., Utica, N. Y.

CALORIMETERS.

Sarco Co., New York.
Schaefer & Budenberg Mfg. Co., Brooklyn, N. Y.

COILS, PIPE.

Simmons Co., John, New York.

Air.

New York Blower Co., Chicago, Ill.

COOLERS.

Oil.

Griscom-Russell Co., New York.

CONDENSERS.

Alberger Heater Co., Buffalo, New York.
Alberger Pump & Condenser Co., New York.
American Radiator Co., Chicago, Ill.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTERS, HOT WATER.

Patterson-Kelley Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

COVERING, PIPE.

American District Steam Co., No. Tonawanda, N. Y.
Century Conduit Co., Pittsburgh, Pa.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

DAMPERS, DUCT.

Sixth City Sheet Metal Works, Co., Cleveland, O

DEHUMIDIFYING APPARATUS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

DISTILLERS.

Water.

Griscom-Russell Co., New York.

DRYING SYSTEMS.

(See Air Cooling and Drying Systems.)

DUST COLLECTING SYSTEMS.

American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

DUST COLLECTORS.

Atmospheric Conditioning Corp., Phila., Pa.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F. Hyde Park, Boston, Mass.

DUST DETERMINATORS.

Atmospheric Conditioning Corp., Phila., Pa.
E. Vernon Hill Co., Chicago, Ill.

ECONOMIZERS, FUEL.

Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EQUALIZING LOOPS

Hoffman Specialty Co., New York.

EXHAUST SYSTEMS.

Hartmann Co., Charles, Brooklyn, N. Y.

ENGINES.

Steam, Automatic.

American Blower Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F. Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam, High Speed.

American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EVAPORATORS.

Boiler Feed Make-up.

Griscom-Russell Co., New York.

EXHAUST HEADS.

Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Simmons, Co., John, New York.
Surtevant Co., B. F., Hyde Park, Boston, Mass.
Wright-Austin Co., Detroit, Mich.

EXPANSION JOINTS.

Alberger Pump & Condenser Co., New York.
American District Steam Co., No. Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.
Century Conduit Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.

FANS, EXHAUST.

American Blower Co., Detroit, Mich.
Batterman-Truitt Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hackney Mfg. Co., St. Paul, Minn.
Hersh Brothers Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

FILTERS.

Aerating.

Griscom-Russell Co., New York.
Johns-Manville, Inc., New York.

Feed-water.

Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

FITTINGS, FLANGED

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
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Jenkins Bros., N. Y.

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Johns-Manville, Inc., New York.
Sarco Co., New York.

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Draft.

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Jas. P. Marsh & Co., Chicago, Ill.
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Jas. P. Marsh & Co., Chicago, Ill.

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American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American Dist. Steam Co., North Tonawanda, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Webster & Co., Warren, Camden, N. J.

Vacuum.

Bishop & Babcock Co., Cleveland, O.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Taylor Instrument Co., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

Water.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American District Steam Co., No. Tonawanda, N. Y.
Detroit Lubricator Co., Detroit, Mich.
Jenkins Bros., New York.

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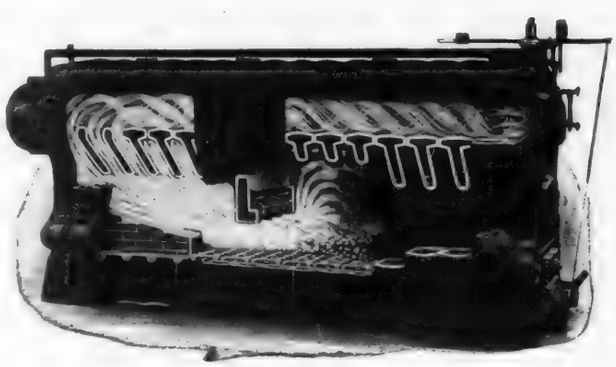

Sectional view of Imperial Super-Smokeless Boiler, showing Hot Blast Chamber.

Utica Heater Company

Utica **New York**

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ENGINEERS' SPECIFICATION INDEX (Continued).

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Atmospheric Conditioning Corp., Phila., Pa.

GOVERNORS, PUMP.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Plant Engineering & Equipment Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

HEATERS.
Domestic Water.
Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., No. Tonawanda, N. Y.
American Radiator Co., Chicago, Ill.
Dahlquist Mfg. Co., Boston, Mass.
Excelso Specialty Works, Buffalo, N. Y.
Patterson-Kelley Co., New York.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water (Closed).
Alberger Heater Co., Buffalo, N. Y.
Alberger Pump & Condenser Co., New York.
Griscom-Russell Co., New York.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims, Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water (Open).
Griscom-Russell Co., New York.
Sims Co., Erie, Pa.
Webster & Co., Warren, Camden, N. J.

Fuel-oil.
Griscom-Russell Co., New York.

Pipe Coil (Air).
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HEATING SYSTEMS.
Unit Blast.
American Blower Co., Detroit, Mich.
BattermanTruitt Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Unit Air.
Moline Heat, Moline, Ill.

Gravity and Forced Circulation, Water.
Alberger Heater Co., Buffalo, N. Y.

Vacuum.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

Vapor.
American District Steam Co., No. Tonawanda, N. Y.
Dunham Co., C. A. Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Il.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Moline Heat, Moline, Ill.
Sarco, Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

HUMIDIFIERS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago Ill.
Spray Engineering Co., Boston, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HUMIDITY CONTROL.
Atlas Valve Co., Newark, N. J.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.

HYGROMETERS.
Jas. P. Marsh & Co., Chicago, Ill.
Taylor Instrument Cos., Richester, N. Y.

INSTRUMENTS.
Electric Measuring.
Cleveland Instrument Co., Cleveland, O.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Indicating and Recording.
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E. Vernon Hill Co., Chicago, Ill.
Johns-Manville, Inc., New York.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Sarco Co., New York.
Sixth City Sheet Metal Works Co., Cleveland, O.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

INSULATING MATERIALS.
American District Steam Co., No. Tonawanda, N. Y.
Banner Rock Products Co., Alexandria, Ind.
Century Conduit Co., Pittsburgh, Pa.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Weatherstrip Manufacturers' Association.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

MECHANICAL DRAFT APPARATUS.
American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Plant Engineering & Equipment Co., New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

METERS.
Condensation.
American Dist. Steam Co., No. Tonawanda,
Central Station Steam Co., Detroit, Mich.
Hornung, J. C., Chicago, Ill.
Plant Engineering & Equipment Co., New York.

Feed Water.
Central Station Steam Co., Detroit, Mich.
Simmons Co., John, 110 Center St., New York.

(Feed Water (Wier Type).
Webster & Co., Warren, Camden, N. J.

Pitot Tube.
American Blower Co., Detroit, Mich.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Steam.
American District Steam Co., No. Tonawanda, N. Y.

MOTORS.
Electric.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

OZONATORS.
Ozone Pure-Airifier Co., Chicago, Ill.

PAINT, FOR HEATED SURFACES.
Ric-Wil Co., Cleveland, O.

PIPE.
Soil.
Simmons Co., John, 110 Center St., New York.

Steel.
Simmons Co., John, 110 Center St., New York.

Wrought Iron.
Simmons Co., John, 110 Center St., New York.

Wood.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.
Buffalo Forge Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Simmons Co., John, 110 Center St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING, WOOD.
American District Steam Co., No. Tonawanda, N. Y.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE HANGERS.
Jenkins Bros., New York.
Simmons Co., John, New York.

PIPE CUTTING AND THREADING MACHINES.
Crane Co., Chicago, Ill.
Toledo Pipe Threading Machine Co., Toledo, O.

PIPING, POWER.
Crane Co., Chicago, Ill.
Simmons Co., John, New York.

POWER PLANT SUPPLIES.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Johns-Manville Co., New York.
Plant Engineering & Equipment Co., New York.
Simmons Co., John, New York.

PUMPS.
Boiler Feed.
Advance Pump & Compressor Co., Battle Creek, Mich.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Plant Eng'g & Equipment Co., New York.
Yeomans Bros., Chicago, Ill.

Centrifugal.
Alberger Pump & Condenser Co., New York.
Allenclif Engineering Co., Columbus, O.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Plant Engineering & Equipment Co., New York.
Thomas Pump Works, New York.
Yeomans Bros. Co., Chicago, Ill.

Condensation.
American Steam Pump Co., Battle Creek, Mich.
Allenclif Engineering Co., Columbus, O.
Chicago, Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Nash Engineering Co., So. Norwalk, Conn.
Thomas Pump works, New York.
Thompson Mfg. Co., Des Moines, Ia.
Trane Co., La Crosse, Wis.
Yeomans Bros. Co., Chicago, Ill.

Rotary.
Connersville Blower Co., Connersville, Ind.
Nash Engineering Co., So. Norwalk, Conn.
Thomas Pump Works, New York.
Thompson Mfg. Co., Des Moines, Ia.
United Vacuum Appliance Division, Connersville, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam.
Advance Pump & Compressor Co., Battle Creek. Mich.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Ideal Heating Equipment Co., Cleveland, O.
Nash Engineering Co., So. Norwalk, Conn.
Plant Engineering & Equipment Co., New York.

Turbine.
Alberger Pump & Condenser Co., New York.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.
Yeomans Bros., Chicago, Ill.

Vacuum.
American Steam Pump Co., Battle Creek, Mich.
Bishop & Babcock Co., Cleveland, O.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Connersville Blower Co., Connersville, Id.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Thompson Mfg. Co., Des Moines, Ia.
Trane Co., La Crosse, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yeomans Bros., Chicago, Ill.

PYROMETERS.
Cleveland Instrument Co., Cleveland, O.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RADIATOR HANGERS.
Gloeckle, Jr., A. F., Rochester, N. Y.
Hartman Co., Chas., Brooklyn, N. Y.
Healy-Ruff Co., Minneapolis, Minn.

RADIATORS, STEAM AND WATER.
American Radiator Co., Chicago, Ill.
Gurney Heater Mfg. Co., Boston, Mass.
International Heater Co., Utica, N. Y.
Simmons Co., John, New York.

RECEIVERS.
Air.
American District Steam Co., No. Tonawanda, N. Y.
Sterling Engineering Co., Milwaukee, Wis.

Condensation.
Advance Pump & Compressor Co., Battle Creek. Mich.
Allenclif Engineering Co., Columbus, O.
American Steam Pump Co., Battle Creek, Mich.
Chicago Pump Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Thomas Pump Works, New York.
Yeomans Bros., Chicago, Ill.

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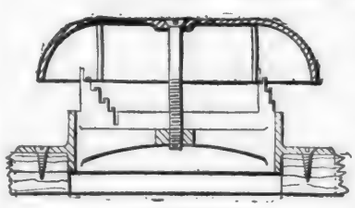

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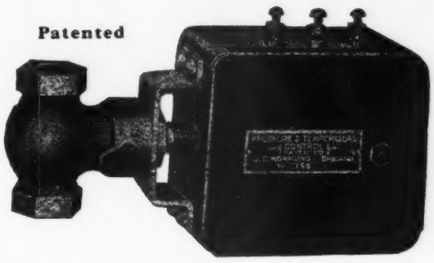

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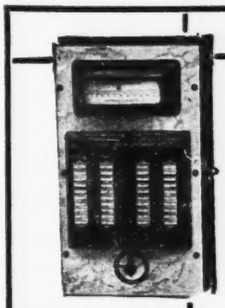

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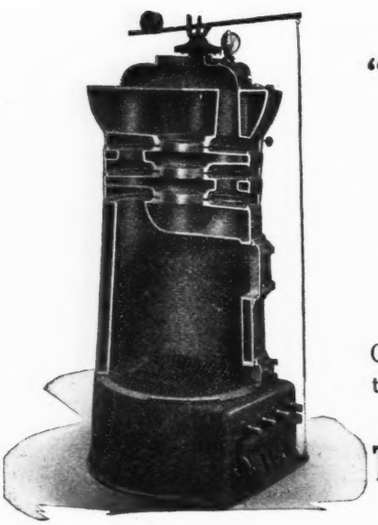

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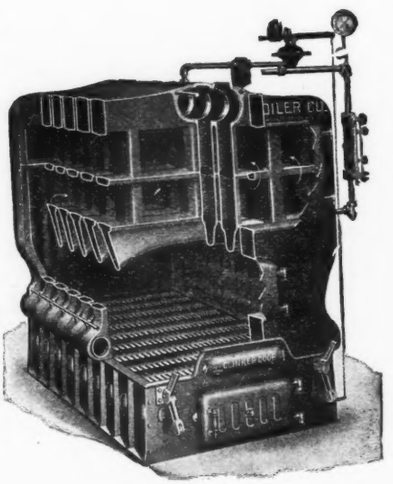

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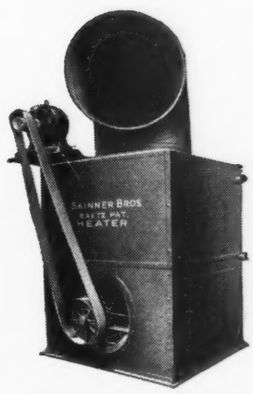

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Skinner Bros. Baetz Patent HEATING SYSTEM.

Skinner Bros. Mfg. Co., Inc.
1426 S. Vandeventer Avenue, St. Louis, Mo.

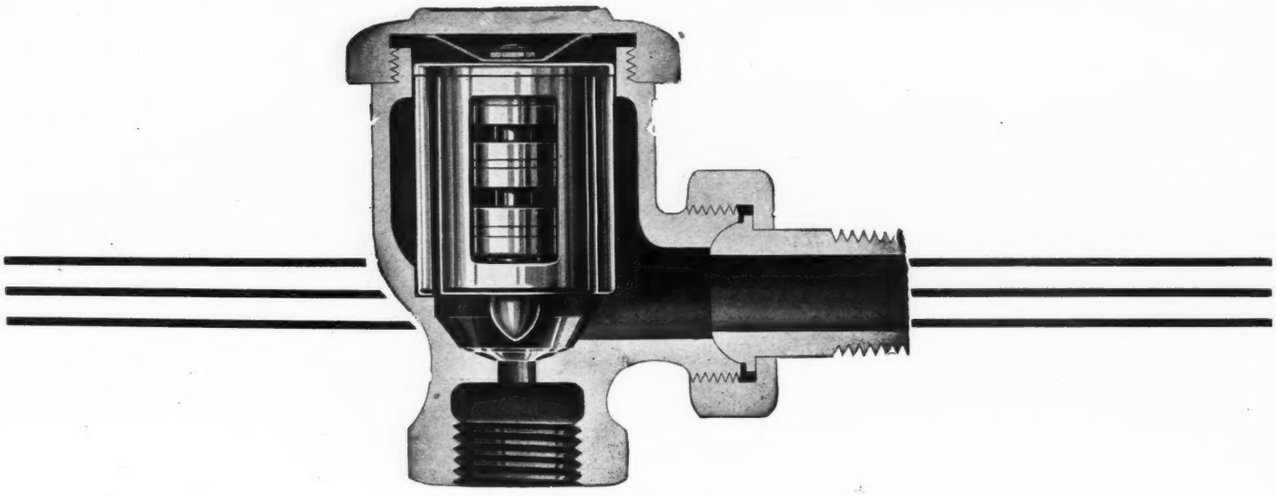
Please send complete details on Skinner Bros. (Baetz Patent) Heaters to

Firm .....

Address .....

Building used for.....

We can / cannot use steam.



No. 8 Hoffman Return Line Valve

When you include HOFFMAN VALVES in your specifications

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Engineers who are familiar with the Hoffman Return Line Valve know that it fulfills every requirement both as to the specification and test.

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